

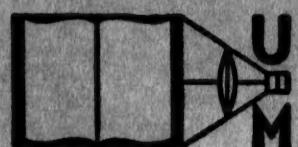
Vol. XVI

No. 11

# DISSERTATION ABSTRACTS

*ABSTRACTS OF DISSERTATIONS AND  
MONOGRAPHS IN MICROFORM*

UNIVERSITY MICROFILMS  
ANN ARBOR, MICHIGAN: 1956



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## INTRODUCTION

This year for the first time *Dissertation Abstracts* will carry, as the 13th issue of Volume XVI, an index to all doctoral dissertations published in the United States and Canada. This issue will be titled *Index to American Doctoral Dissertations*, and will be a continuation of *Doctoral Dissertations Accepted by American Universities*.<sup>1</sup> The joining of these two reference works makes it possible for librarians to have an integrated bibliographical research tool relating to doctoral dissertations under one cover.

*Dissertation Abstracts* will continue to provide abstracts of dissertations by recipients of doctoral degrees from graduate schools cooperating with University Microfilms in the publication of complete dissertation texts on microfilm, on Microcards, or as microprint. At the end of each abstract will be found an indication of the number of pages in the original typescript and the Library of Congress card number, for the convenience of scholars and research workers. In some instances *Dissertation Abstracts* will be found to be an adequate substitute for the published dissertations.

The *Index to American Doctoral Dissertations* will be a complete indexed listing of dissertations by students who were granted doctoral degrees during the previous academic year, and including those abstracted in *Dissertation Abstracts*, arranged by degree-granting institutions under appropriate subject headings. An alphabetical author index will be included.

The tabular material which has been an established part of its predecessor volume will be included in full, so arranged that statistical summaries can be maintained with no break in continuity.

It is hoped that those who use *Dissertation Abstracts* will continue to make suggestions for its improvement, as these are vital to its continued life and growth. Several suggestions for changes in the headings used for indexing purposes have been received, and a committee of the Association of Research Libraries is reviewing the indexing system at the present time as a result of these suggestions.

<sup>1</sup>Arnold H. Trotier and Marian Harman, (eds.), *Doctoral Dissertations Accepted by American Universities*. (New York: H. W. Wilson Co., 1933-1955.)

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## AGRICULTURE

### AGRICULTURE, GENERAL

#### ECONOMIC ANALYSIS OF LAND REFORM IN THE REPUBLIC OF KOREA WITH SPECIAL REFERENCE TO AN AGRICULTURAL ECONOMIC SURVEY, 1954-1955

(Publication No. 18,183)

Ki Hyuk Pak, Ph.D.  
University of Illinois, 1956

In this thesis of slightly over 200 pages, about 78 pages are devoted to background information about Korea and its land problems. An almost equal space is devoted to summarizing results of a field study which the author made during a special trip to Korea. In the absence of evidence that any preceding studies of the same kind had been made since the war, the writer has enlisted the help of some trained men and of some agricultural college students in his homeland so as to obtain information from householders in twenty agricultural villages in five provinces in the Korean Republic. On most topics information was collected from 360 farm households. The information sought was for three recent dates, namely, 1949 (before the Korean war and land reform), 1952 (during the war and early stages of land reform), and 1955 (the scheduled last year of land-acquisition payments).

Since the writer believes that the Republic of Korea can survive as a self-supporting economy if the best possible use is made of all its economic resources, without assuming reunification within the near future, this study aims to analyze the effects of land reform in making significant changes in the agrarian economic structure. The objective must be to improve the rural life, and in the long run the national life, of the Republic of Korea. Industrial development might well be based upon agricultural needs and resources: fertilizers, textiles, farm and foods machinery, and the like.

This study is concerned especially with analyses of the effects of land reform upon (1) agricultural productivity; (2) marketing of farm products; (3) the status of the tenant-purchaser and his former landlord; (4) the agricultural policies of the government and its actions with respect to land reform, farm credit, farm taxation, and other farm problems; and (5) methods for promptly improving the changing agricultural economy.

A significant finding in this study is that between 1950 and 1955, the moderately large farms had increased their size and the medium and small farms declined in size. There is some evidence since 1950 of changing of land ownership and creation of new tenancies. Experience seems to the writer to have shown that the concept of land reform must be broadened from the traditional principle of "land-to-the-tiller" to include the economic reconstruction of the whole agrarian system. The small farmer, in particular, should become economically more productive. Much work will be required of government educational and

extension services, including help in organizing farmer cooperatives for financing, producing, and marketing farm products. There should be an early comprehensive program for all of Korea to work toward equitable taxation and toward the conservation and improvement of the land resources through irrigation and reclamation projects.

Although all segments of the national economy need to be better developed, including the industrial segment, no one segment should be supported and expanded at the expense of another. Agriculture has been the mainstay of the national economy, and it is certain to continue to be of basic importance in the future. By means of a balanced and comprehensive economic program, based upon continuous empirical observation and study, it seems entirely possible to achieve for Korea a self-sufficient and stable economy within ten to fifteen years.

214 pages. \$2.80. Mic 56-2769

### THE IMPACT OF TECHNOLOGY ON THE DAIRY INDUSTRY

(Publication No. 18,878)

Thomas Caroli Walz, Ph.D.  
Purdue University, 1956

Major Professor: Charles E. French

The objectives of this study are: (1) to develop quantitative input-output relationships for the manufactured dairy products industry and the fluid milk industry, and to evaluate their change through time, (2) to relate historical events and major technological developments to changes in the input-output relationships, and (3) to make conclusions, recommendations and general observations to assist the dairy industry in adjusting to future technological changes.

The Manufactured Dairy Products Industry. Over the period 1919-1947, the inputs required to produce a given net output<sup>1</sup> declined roughly 66 per cent; or, a 2.2 per cent decrease per year. The input/net output ratio fell about 48 per cent from 1919-1929; about 23 per cent between 1929-1937, and about 14 per cent between 1937-1947.

Savings of resources were about 25 per cent between 1919-1947; or, about a 1.0 per cent savings per year. The quantity of resources involved increased by about 13 per cent from 1919-1929 when the industry was undergoing rapid expansion; declined about 16 per cent from 1929-1937, and further declined about 22 per cent between 1937-1947.

Between 1919-1929, all factor inputs increased per unit of gross output<sup>2</sup> except labor. Intimately associated with this increase was the adoption of the farm separator on most farms in the dairy belt. The return to the gathered cream system was accompanied by the introduction of

cream buying stations, centralizer creameries, large selling cooperatives, national dairy organizations and the advent of direct marketing of dairy products which were beginning to be packaged in a more convenient form.

Technological innovations in this period were largely concerned with changes in the basic methods of manufacture. Railroads and the recently perfected motor truck provided ease of transport and expanded market areas. The electric motor made possible greater flexibility and efficiency in plant operation. Improved refrigeration facilities, better methods of communication, higher standards of quality and sanitation, and wider spread of knowledge concerning the manufacture of dairy products all contributed to the expansion in this industry.

From 1929-1937, the gains made in the previous decade were solidified. Major emphasis was placed on greater utilization of whole milk. No longer was so much skim milk fed to animals on farms or indiscriminately poured down the drain. The development of techniques for drying the non-fat portion of milk was mainly responsible for about a 20 per cent decline in inputs of milk necessary to produce a given gross output. Even if farm milk production had not risen, the net effect of greater utilization of milk by manufacturing plants was to increase the amount available for sale.

War-time conditions dominated the 1937-1947 period. The scarcity of capital items resulted in a substantial substitution of capital by labor. Trends in declining inputs of milk, and rising inputs of supplies other than milk per unit of gross output continued into this period.

**The Fluid Milk Industry.** Inputs required to produce a given net output fell by between 23-37 per cent from 1941-1954; or, about a 2.1 per cent decline per year. A 31-46 per cent decrease was experienced from 1941-1947; whereas an 11-16 per cent increase occurred between 1947-1954.

Between 1941-1954, savings of resources were about 8 per cent; or, about a 0.6 per cent decline per year. An 11 per cent decrease occurred from 1941-1947; whereas a 3.5 per cent increase was experienced between 1947-1954.

Substantial substitution of capital by labor occurred from 1941-1947. Inputs of supplies other than milk per unit of gross output increased greatly. The introduction of alternate-day delivery of milk assisted in the decline in total inputs per unit of gross output during this period.

Between 1947-1954, inputs per unit of both gross and net output exhibited a definite increase in all factors except labor on the gross output base. With the cessation of war-time conditions this industry emphasized replacement of old by new plant and equipment. It continued the emphasis on labor saving innovations such as materials handling, in-place cleaning, more efficient equipment and greater reliance on automatic control devices. Movement of milk through high-temperature short-time pasteurizers, homogenizers and clarifiers in one continuous process replaced in large measure the batch type processing of pre-war days. New products, new containers, and new uses for milk were other areas of special interest.

278 pages. \$3.60. Mic 56-2770

1. The net output definition refers to output as value added by manufacture with inputs defined as the sum of labor and capital.

2. The gross output definition refers to output as total sales with inputs defined as the sum of labor, capital and intermediate products.

## PART-TIME FARMING IN OHIO, WITH SPECIAL REFERENCE TO ITS USE AS A ROUTE TO FULL-TIME FARMING

(Publication No. 18,825)

William Allen Wayt, Ph.D.  
The Ohio State University, 1956

Part-time farming has become increasingly important in the social fabric of rural Ohio. The study was undertaken to provide a better understanding of the place of this phenomenon in Ohio, with major emphasis on the following questions: What kind of people are engaged in part-time farming? What are their goals or objectives? How well have these goals been realized? What agricultural resources do part-time farmers command, and how did they obtain their use? Is part-time farming an effective route to full-time farming?

Information relating to these questions was secured by interview from over 300 present and former part-time farmers residing in seventeen Ohio counties selected to represent the various types of farming followed in different areas of the state. To facilitate study of the broad range of situations in which farming is combined with another job or occupation, a farm operator was considered as "part-time" if he worked off the farm 100 days or more a year.

Part-time farming is the result of a two-way movement. Former full-time farmers have taken nonfarm work and continued to operate all or part of the land previously farmed. Former urban residents, often farm-reared, have moved to farm areas in quest of the amenities of rural living and continued to hold their nonfarm jobs. This two-way movement is facilitated by growth and decentralization of industry, good roads, and rapid transportation. The average part-time farmer traveled 13 miles one way to work and spent about one-half hour en route.

Part-time farming is not necessarily small-scale or subsistence farming. The average part-time farmer interviewed farmed about 70 acres and sold farm products valued at about \$1,800; some operated in excess of 300 acres and reported gross farm product sales of over \$10,000 annually. The farm operations of some part-time farmers are larger than those of other operators who spend full time on the farm. The census definition of a part-time farm understates the importance of part-time farming in Ohio as an operational concept.

Income of part-time farm families from nonfarm work in various occupations averaged about \$4,000, but ranged from less than \$1,000 to in excess of \$10,000 annually. There was no consistent relationship between the level of farm sales and nonfarm income.

Most part-time farmers have purchased land, and hold title to over three-fourths of the land they operate. Their financial position, length of tenure on the farms and in the nonfarm jobs, and expressed personal satisfaction with their present situation indicate that part-time farmers are a stable part of our rural population. After ten years of combining a nonfarm job with farming and country living, the typical situation, few planned to leave the farm.

The utilization of agricultural resources by part-time farmers is substantially the same as by all farmers. Crop land harvested relative to total acreage, yield per acre of major crops, and machinery investment per crop acre were all essentially the same as averages for all farmers.

Part-time farming is a method whereby some individuals have been successful in accumulating the capital and

obtaining command of the agricultural resources needed to farm full time on a commercial scale. Others who tried, failed to achieve this goal. Managerial ability, hard work, perseverance, family coöperation, judicious use of credit, experience, and the ability to learn from past mistakes are factors evident in the case histories of those who successfully traveled the part-time route to full-time farming.

296 pages. \$3.80. Mic 56-2771

## AGRICULTURE, ANIMAL CULTURE

### EFFECTS OF ARSANILIC ACID AND CERTAIN ANTIBIOTICS ON CHICK GROWTH

(Publication No. 17,291)

Okra Jones Abbott, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Professor Herbert Roderick Bird and  
Professor Carl August Baumann

Growth stimulation and well-being of chicks fed certain antibiotics and other antibacterial agents have been studied. Experiments were conducted with New Hampshire x Single Comb White Leghorn crossbred chicks to 3 weeks of age except that they were continued to 10 weeks when toxic effects of high levels of arsanilic acid were investigated. Chicks were grown in conventional batteries on raised wire floors. Feed and water were supplied ad libitum.

During a three-year period the growth response of chicks to penicillin fed at low to intermediate levels disappeared, but reappeared and disappeared again in the same laboratory. Responses tended to be associated with lower basal gains. Growth of the basal groups averaged 9 percent higher when responses to the antibiotic disappeared than when positive responses were occurring.

The effect of arsanilic acid on chick growth was similar to that obtained with penicillin. Growth was promoted by both compounds simultaneously, and the response to each disappeared concurrently. Thiamine was spared for the chick by both penicillin and arsanilic acid as indicated by the superior growth responses obtained at suboptimal dietary levels of the vitamin.

Arsanilic acid did not inhibit growth of chicks to 10 weeks of age when fed at levels below 1000 milligrams per kilogram of diet. The slight growth depression occurring at this level increased as greater amounts of the arsenical were fed. Symptoms of toxicity, resembling those of thiamine deficiency, occurred at levels of the arsenical of 1500 milligrams or higher per kilogram. Mortality began at 2000 milligrams per kilogram and increased in severity as higher levels of arsanilic acid were included in the diet.

The feeding of a diet containing 90 milligrams of arsanilic acid per kilogram to chickens to 70 days of age resulted in the deposition in liver of 3.1 micrograms of arsenic per gram of wet tissue. (Arsenic was determined by the method of Kingsley, *et al.*, Anal. Chem. 23:914-919, 1951, as modified by Evans, *et al.*, Anal. Chem. 26:595-598, 1954.) Deposition increased to about 8 micrograms per gram of tissue at 500 milligrams of arsanilic acid and

did not go higher as levels of the arsenical in the diet were raised to 1500 milligrams per kilogram. Slightly greater amounts accumulated in liver at higher dietary levels of arsanilic acid. Considerably smaller amounts of arsenic were deposited in breast muscle amounting to 0.32 microgram per gram of tissue at the level of 500 milligrams of arsanilic acid per kilogram of diet. Arsenic was deposited in skin in amounts intermediate between those in breast muscle and in liver. Averages of 6.9 micrograms per gram of skin occurred when 2250 milligrams of arsanilic acid per kilogram of diet was fed compared to 1.9 micrograms in breast muscle and 11.1 micrograms in liver.

In the limited number of experiments conducted, phosphanilic acid, an analog of arsanilic acid not containing a potentially toxic element, did not appear to promote growth. However, it seemed to spare thiamine for the chick as did arsanilic acid.

Growth obtained in the first of duplicate experiments conducted with folic acid-deficient diets was superior to that obtained in the second. In the presence of aureomycin this superior growth was depressed and resembled the inferior but more consistent responses to increased dietary levels of folic acid obtained in the second experiment. Aureomycin did not further depress the inferior growth that occurred in the second experiment, and penicillin did not depress it in either instance. In general, neither antibiotic promoted a growth response. Storage of folic acid in liver was increased at 4 of 5 dietary levels of the vitamin by penicillin but at only 2 of the 5 levels by aureomycin.

99 pages. \$1.50. Mic 56-2772

### SOME FACTORS WHICH AFFECT HATCHABILITY OF CHICKEN EGGS AT HIGHER ALTITUDE

(Publication No. 18,834)

Edward George Buss, Ph.D.  
Purdue University, 1956

Major Professor: Dr. B. B. Bohren

The development of grams per cent hemoglobin in the allantoic blood of 1,778 chicken embryos from ninety-five hens was studied beginning on the twelfth and continuing through the twentieth day of incubation in an atmosphere of approximately twenty-one per cent oxygen at an altitude of 5,000 feet. The per cent hatch of fertile eggs, however, was determined at an oxygen pressure of eighteen to twenty per cent at 5,000 feet in an effort to obtain maximum variability for hatchability. The average per cent hatch of fertile eggs was approximately fifty-nine, and the range was from zero to ninety-seven.

Embryonic hemoglobin was taken from an allantoic blood vessel where it touched the inner shell membrane. A sample of 0.1 cubic centimeters of blood was diluted in fifty cubic centimeters of a 0.1 per cent solution of sodium carbonate. Hemoglobin was determined by using a Coleman spectrophotometer.

The association of embryonic hemoglobin with the per cent hatch of fertile eggs was determined. By partial correlation and regression analyses, the association of egg production, egg size, time of hatch and fourteen-day embryonic hemoglobin with per cent hatch of fertile eggs was determined.

The following conclusions may be made for the conditions of the investigation:

The grams per cent hemoglobin of the allantoic blood from chicken embryos increased from the twelfth day through the eighteenth day then declined during the nineteenth and twentieth days.

Embryos from eggs of hens with poor hatchability had significantly lower hemoglobin values on the thirteenth and fourteenth days and a trend for higher hemoglobin values on the eighteenth, nineteenth and twentieth days than embryos from eggs of hens with high hatchability.

Increased egg production during the hatching period, earlier time of hatch and smaller mean egg size were significantly correlated with higher hatchability.

With oxygen pressure between eighteen and twenty per cent at 5,000 feet, retarded hemoglobin development was associated with a delay in time of hatch and with a lower per cent of the embryos successfully emerging from the eggs in twenty-two days.

53 pages. \$1.50. Mic 56-2773

#### STUDIES ON VIRUS DIARRHEA IN CATTLE

(Publication No. 18,836)

Robert George Carlson, Ph.D.  
Purdue University, 1956

Major Professor: William R. Pritchard

These studies were undertaken in an effort to more fully describe the course and nature of virus diarrhea in cattle, one of the more recently recognized bovine diseases.

The clinical signs and pathological lesions observed in 20 cases of experimentally produced disease were closely analogous to those of the naturally occurring disease. In general, however, the naturally occurring disease tended to be more severe in nature than experimental infections.

Experimental exposure of susceptible calves to the causative agent was followed by a diphasic temperature response in most instances. Typically there was an initial 1.0 to 3.0 F. rise in body temperature on the third to fifth day post-exposure. Leucopenia, general malaise, respiratory signs and diarrhea, associated with pathological alterations of the alimentary tract, occurred in most of the experimentally inoculated calves during and after the second phase. Clinical signs of lameness and exacerbations and remissions were also common to both field and experimental disease.

The most pronounced clinical and pathological signs of disease were observed in five calves 10 to 15 months of age. Clinical examination failed to reveal signs of disease in two calves under three months of age following exposure. In addition, exposure of eight pregnant cows from a herd in which the majority of the animals were over four years of age, failed to produce clinical signs of disease in either the animals inoculated or in the cattle with which they had contact. Calves included in this herd were later shown to be susceptible to the causative agent.

An effort was made to characterize the pathology of virus diarrhea by a comparative study of experimentally produced and naturally occurring cases of the disease. The mucosa of the alimentary tract, from the muzzle to

the anus, and lymphoid tissue were the most characteristic sites for pathological alteration to occur. Lesions of the digestive tract were primarily of an erosive and ulcerative nature and were associated with edema, congestion and hemorrhage, particularly in those areas where only a single cell layer separates the lumen of the tract from the underlying vascular stroma. Edema and exhaustion of the germinal centers were the principal changes observed to involve lymphoid tissue. Considerable variation was observed in the degree of pathological involvement that occurred in both field and experimental cases of the disease. Comparisons were made between virus diarrhea as it occurs in Indiana and other diseases of cattle associated with similar clinical and pathological changes.

The agent was propagated in the immature rabbit with no apparent clinical signs in that species. Material from the sixth, nineteenth, twenty-fourth and thirtieth rabbit passages produced clinical signs of disease in calves. These calves were later shown to be immune to reinfection. A decrease in virulence of the agent for calves may have resulted by the thirtieth rabbit to rabbit passage.

By calf inoculation it was shown that the agent could withstand exposure *in vitro* to 2,000 units of penicillin and 25 mg. of dihydrostreptomycin per milliliter of final inoculum for at least one-half hour at 27.5 C. The agent also withstood freezing and storage at -40 C. for ten months without an apparent alteration in virulence.

Attempts made to demonstrate hemagglutinative activity and fixation of complement employing antigens made from lymph node suspensions and hemolyzed whole blood were negative.

Applications of the agent to tissue culture technics were inconclusive. A consistent cytopathological effect was not demonstrable on either spleen, lymph node, lung or kidney tissue explants, or on monolayer kidney epithelial cell cultures. Bovine fetal tissues were employed in these trials.

116 pages. \$1.50. Mic 56-2774

#### THE SURVIVAL OF BOVINE SPERMATOZOA SUBJECTED TO DIFFERENT PROCEDURES OF FREEZING AND THAWING

(Publication No. 19,087)

Olin Tracy Fosgate, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Dr. Vearl R. Smith

This study concerns itself with increasing the survival of bovine spermatozoa which have been frozen and stored at -79° C. About thirty to fifty percent of all bovine sperm cells are immobilized by the freezing and thawing procedures now used.

The semen which was used in this study was diluted to one-half of its final volume with 24 percent egg-yolk-citrate (E.Y.C.) immediately after collection. After slowly cooling to 5° C., it was extended to its final concentration of 1:30 with E.Y.C. containing 15 percent glycerol.

Freezing trials in which 1.25 percent w/v of fructose or ribose were added failed to improve survival over the E.Y.C. controls. A glycerol equilibration period of twenty-one hours was superior to either a two- or a four-hour equilibration period.

After a series of preliminary freezing trials indicated that the addition of a surface active agent might be beneficial, a randomized incomplete block design experiment was set up to test five of the surfactants. Six Holstein bulls were used in the study; each bull was used five times. Three bulls constituted a block. Each of the ten blocks tested two surfactants at two levels--1:4000 and 1:10000--along with duplicate control samples. Duplicate samples were thawed and examined for survival and motility after 0 hours storage and again after seven days of storage at -79° C. Six separate analyses of variance were computed. Duncan's New Multiple Range Test was used to compare the ranked treatment means. The analyses revealed a significant interaction between level and treatment ( $P < .05$ ) and a highly significant difference ( $P < .01$ ) between treatment means. Samples containing the surface active agent, Triton WR-1339, exhibited extremely low survival. After seven days of storage at -79° C. four of the five surfactants (Tween 21, Tween 80, Halco #3, and Saponin) were found to increase the survival of bovine spermatozoa significantly ( $P < .01$ ). Semen samples containing Tween 80 at 1:4000 were highly significantly better than any other treatment or control.

A loss of 6.01 percentage points in survival due to seven days of storage was found based upon 120 control observations. A loss of .3 in progressive motility was found based upon a rating of 0 to 10. The mortality of motile cells due to storage for semen containing a surface active agent was slightly higher. Tween 80 gave the greatest protection against damage from freezing and thawing. The increase in survival of motile cells due to the addition of Tween 80 was highly significant ( $P < .01$ ).

58 pages. \$1.50. Mic 56-2775

#### STUDIES ON ASSOCIATIONS BETWEEN CELLULAR ANTIGENS AND BUTTERFAT PERCENTAGE IN DAIRY CATTLE

(Publication No. 18,813)

P. Gopinathan Nair, Ph.D.  
The Ohio State University, 1956

The problem of predicting the future producing capacity of young stock has been a fascinating one for breeders of dairy cattle since the earliest days of dairy husbandry. Even though a great deal is known about the inheritance of cellular antigens, very little work has been done in trying to use them as markers of production traits. Since it became apparent (after reviewing the early literature and evaluating previous work in the laboratory) that butterfat percentage would be more heritable than most production characters, possible associations between cellular antigens and butterfat percentage were investigated.

The animals available for study were high-producing Holsteins from three herds. Inbred as well as outbred animals were available in all the herds. Nine hundred twenty-two animals which had completed their first lactations without complications and had been blood-tested were included in the study.

The problem was approached from three angles. First, the average butterfat tests of animals having each antigen were compared with the average tests of those lacking the

antigen. The significances of the differences were tested by the t-test for group comparisons. These comparisons were made within herds as well as within sire families in the same herd. As a result of this study several significant differences were observed, but it appeared that most of the significant findings were confined to the antigens in the B system.

Next, the animals were divided into age groups, each age group being considered an estimate of a paternal generation. Changes in frequencies of antigens from one age group to another were compared with corresponding changes in butterfat percentages. Regressions of the antigen frequencies on butterfat percentage were calculated, and the significances of the regressions were tested by the t-test. All the significant regressions were confined to the antigens in the B system.

The possible effects of interactions of antigens controlled by genes on different loci were studied by comparing all possible combinations of a few antigens. These antigens in turn were selected on the basis of maximum associations with high or low butterfat test in the direct-comparison studies. The results of this study did not supply any evidence suggesting interactions of antigens controlled by genes on different loci, which produce significant changes in fat test.

The most consistent and significant associations observed were confined to the B system. Antigens G, Y, C', E', and J' and Groups BYC', GYC', and GYE' were observed in the presence of high fat test, while antigens B, G, I, and O and group BGIOT were associated with low butterfat test. It appeared that a few statistically significant but inconsistent associations were observed for antigens outside the B system. These were considered to be chance correlations. The limited studies on interactions seemed to support the view that only antigens in the B system were associated with butterfat test.

The results do not seem to suggest the conclusion that any single antigen mentioned above is associated with butterfat test. What is, apparently, most likely is that the B system (in which most associations were observed) as a whole is associated with butterfat test. An even more significant conclusion is that antigens of the B system are probably of some adaptive value to the animal. It is possible that this adaptive value might supply some explanation for the phenomenal number of multiple alleles in the B system.

Information concerning the lack of adaptive value is also useful. It is likely that the frequencies of antigens outside the B system are controlled by the mathematical laws of probability only. In studies on population genetics of dairy cattle, frequencies of these antigens should supply comparatively less biased estimates of genetic changes.

66 pages. \$1.50. Mic 56-2776

**SOME GENETIC AND ENVIRONMENTAL FACTORS  
AFFECTING LITTER SIZE IN SWINE**

(Publication No. 17,925)

Vaithilingam Rathnasabapathy, Ph.D.  
University of Missouri, 1956

Supervisors: John F. Lasley and Dennis T. Mayer

A study of 114 gilts of the Landrace x Poland and Duroc breeds at the age of maturity, at 55 days of gestation and at parturition revealed that the bulk of embryonic mortality (95 percent) occurred during the first half of gestation. Correlations of ovulation rate, embryonic mortality and litter size at 55 days of gestation with the various body characteristics and growth rate showed a significant and positive association of ovulation rate with weaning weight, 154 day weight and age at breeding of the dam, the regression coefficients being .127 and .045 for every one pound in the weaning and 154-day weights respectively and .48 for every ten days in breeding age. But these factors which influenced ovulation rate increased the mortality rate in a similar manner, litter size being least affected by them, indicating that the excess of ova resulted in an increased mortality rate due to conditions that did not favor their development.

Significant family and breed differences in ovulation, litter size and embryonic mortality gave a partial genetic explanation to the whole reproductive phenomenon. Of the several other factors which were investigated as possible causes of embryonic mortality, over-crowding seemed to play a very significant role. The highly significant positive correlation between length of the uterus and litter size with a regression coefficient of .135 embryos for every 10 centimeters length, and the same type of association between spacing and weight of embryos were adequate to prove this condition. The weight of the embryos was not directly proportional to the spacing but obeyed the law of diminishing returns. When spacing was 50 to 100 mm. the average weight of the embryo was 42 gm. An additional 50 mm. space resulted in an increase of 18.7 gm. The next addition of one unit of 50 mm. brought only 10 gm. increase in the weight of embryo. Further additions of each unit space up to 400 mm. of uterine space brought less than 10 gm. weight increase. Beyond 400 mm. additional space resulted in no further increase in weight.

It was estimated that an optimum space of 350 to 450 mm. should be made available for every fetus at this stage of pregnancy. Inadequate space is bound to cause fetal atrophy and more space not likely to give additional returns unless other determinants are operating effectively.

The significant correlation between mortality rate and the average back fat thickness indicated that fatness is closely associated with a small litter size. The positive association of gains made from 200 pounds to 55 days of gestation with embryonic mortality suggested that limited feeding subsequent to conception is more conducive for a larger litter size.

The above results point out that selection made on the basis of weaning weight and 154-day weight for a larger ovulation rate may not result in a larger litter size unless adequate uterine space is made available. As the length of the gravid uterus is proportional to the length before maturity, selection of breeding stock from families with longer uteri at 200 pounds body weight is recommended.

Other conditions being normal uterine length is one of the very important determinants of litter size.

164 pages. \$2.15. Mic 56-2777

**FACTORS AFFECTING GROWTH,  
FEED EFFICIENCY AND CARCASS  
DESIRABILITY IN SWINE**

(Publication No. 17,930)

Leland Floyd Tribble, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. W. H. Pfander

A replicated 2 x 2 x 2 factorial experiment, involving 128 crossbred and purebred Landrace pigs, was conducted to determine the effects of 16 per cent (HP) and 12 per cent (LP) protein, antibiotics (0 and 18 mg./lb.) and full (FF) and limited feeding (LF) to 85 per cent of a full feed on growth, feed efficiency, and carcass desirability. The effects of these treatments on reproduction were also studied.

The relationship of various carcass and live hog measurements and live hog scores to the per cent of the four lean and fat cuts in the carcass and the average daily gains of the pigs was calculated.

There were no differences in the rate or efficiency of gains of the pigs on the two levels of protein for the entire feeding period. From weaning to 100 pounds, pigs on HP gained 0.15 pound ( $P < .01$ ) per head per day faster than pigs on LP. They also required 25 pounds ( $P < .05$ ) less feed per 100 pounds gain. However, from 100 to 200 pounds, pigs on LP gained 0.11 pound ( $P < .01$ ) per head per day faster and required 26 pounds ( $P < .01$ ) less feed per 100 pounds gain than those on HP. There were no significant differences between protein levels on carcass desirability, but the pigs on HP tended to have leaner carcasses.

The addition of an antibiotic, chlortetracycline, to the ration of pigs from weaning to 200 pounds increased the average daily gains 0.07 pound ( $P < .05$ ) but did not affect feed efficiency as compared to pigs fed no antibiotics. From weaning to 100 pounds, pigs fed an antibiotic gained 0.11 pound ( $P < .01$ ) per head per day faster and required 23 pounds ( $P < .05$ ) less feed per 100 pounds gain. Antibiotics had no effect on carcass desirability.

Restricting the feed intake of pigs to 85 per cent of a full feed resulted in significantly ( $P < .01$ ) slower gains throughout the entire feeding period as compared to FF pigs. LF pigs made more efficient gains for the period from 100 to 200 pounds ( $P < .01$ ) and for the period from weaning to 200 pounds ( $P < .05$ ) than FF pigs. Carcasses from LF pigs contained 1.36 per cent more of the four lean cuts and 1.31 per cent less of the fat cuts, and 0.51 per cent less belly than FF pigs ( $P < .05$ ). LF pigs had significantly ( $P < .01$ ) larger ham muscle areas and longer legs than FF pigs. LF pigs also had 3.25 mm. less back fat ( $P < .01$ ) as measured by the probe technique than FF pigs.

The effects of the various treatments on reproduction were determined by breeding gilts from each treatment and slaughtering them approximately twenty-five days later.

There were no significant differences between any of the treatments on reproduction. LF gilts had a larger number of embryos at twenty-five days than the FF. A greater percentage of the corpora was represented by embryos in the gilts fed antibiotics than those fed no antibiotics. Twelve per cent protein appears to be adequate for embryonic development.

Back fat measured on the carcass or live hog at 200 pounds was the best indicator of fat in the carcass. Average daily gains, heart girth at 200 and 150 pounds, carcass width, and back fat probes at 150 pounds were all significantly ( $P < .01$ ) correlated with the per cent of fat cuts.

Ham muscle area and live hog scores for meatiness were significantly correlated ( $P < .01$ ) and leg length and body length at 150 pounds were also significantly correlated ( $P < .05$ ) with the per cent of the four lean cuts. No significant correlation was obtained between the loin eye area and per cent of the four lean cuts.

104 pages. \$1.50. Mic 56-3143

#### AGRICULTURE, FORESTRY AND WILDLIFE

##### THE PHILOSOPHY AND TECHNIQUES OF SUSTAINED YIELD PLANNING IN FORESTRY

(Publication No. 17,118)

Paul Eric Bruns, Ph.D.  
University of Washington, 1956

This is an evaluation of existing methods of forest regulation. The philosophical and historical development of regulation of cut is presented with emphasis on the work of 19th century European foresters. Appropriate translation is made from the writings of Dr. Carl Heyer of Germany (1841) and others. Interpretation of these foresters' ideas, in part from original sources, strengthens the writer's view that these early practitioners were members of a "classical era" in forest regulation and that in future years their methods and philosophical approach to regulation were to some extent misinterpreted and forgotten.

Regulation techniques are shown as belonging generally either to an "area" regulation or "volume" regulation category. In practice, the regulator must necessarily effect a compromise between these two fundamentally conflicting approaches to regulatory work.

After bringing the historical presentation to date with inclusion of later European and American methods of regulation, the writer presents a summary and suggestions for regulation of the cut. No one method can be universally labelled as most desirable. This is due in part to the many different forest forms and age class distributions within existing forests. However, such as Heyer's 1826 formula as modernized, even methods over a century old can have application today.

A method of area regulation in uneven aged forests is presented that is original with the writer. The writer holds that area regulation is possible in uneven aged stands, just as in even aged stands, although all age classes of trees are growing together in the former, rather than on separate areas. There are points of similarity with a

method developed by the late Donald M. Matthews. Both may be classed as "basal area percentage" methods of area regulation.

The fundamental approach in the writer's method is to assign a percentage of total basal area to each age class required in the eventual desired forest including the reproduction class, adjust this percentage to fit conditions in the actual forest to be regulated, and cut this percentage of the basal area in the actual forest. This adjusted basal area percentage is related to the volume that can safely be cut and theoretically still attain a perfect distribution of age classes in the second rotation. If the result is in conflict with volume regulation, modifications may be made to assure a reasonably sustained flow of raw material during the first rotation. The regulator is, in any event, conscious of the effect of the actual cut on second rotation sustained yield.

There are two examples from recent American experience in regulation presented in an Appendix. These examples are typical cases as encountered in both the uneven and even aged form of forest.

126 pages. \$1.70. Mic 56-3144

##### A STUDY OF THE OLD-SQUAW DUCK ON LAKE MICHIGAN

(Publication No. 17,309)

Robert Scott Ellarson, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor Robert A. McCabe

The old-squaw duck (*Clangula hyemalis*) and other diving birds are taken in large numbers in gill netting set for fish in Lake Michigan. This type of mortality had never been fully investigated. In addition, large numbers of specimens taken in gill nets were available for a study of certain aspects of the life history and ecology of the old-squaw.

Field work was begun in the winter of 1949-50 and completed in the spring of 1955. Fishing data and specimens were collected from gill-net fishermen located on all parts of Lake Michigan.

A total of 9,215 birds taken in gill nets was examined. Of these, 98.6 per cent were old-squaw ducks. Other birds taken were loons, grebes, and five other species of ducks. The largest numbers of old-squaws are taken in the months of February, March and April. Four and one-half inch mesh gill net is over 2.5 times more effective in taking ducks than 2 1/2 inch mesh. Weather conditions also have a strong influence on the numbers of birds taken. The estimated minimum cost to a fisherman is 28 cents per bird caught. Annual mortality to diving birds in gill netting on Lake Michigan was estimated to be 15,539 birds in the 1951-52 season, and 19,562 in the 1952-53 season. During severe winters this mortality may approach 100,000 birds.

Old-squaw ducks are subject to very light hunting pressure; of 1,051 birds fluoroscoped only 0.9 per cent were found to carry body shot. Approximately 35 per cent of the mallards in the Mississippi flyway may carry body shot. No ingested shot was found.

Juvenile old-squaws can be distinguished from adults through the month of May following the year of hatching,

on the basis of both plumage and cloacal characters. Sex and age ratio data gathered from 6,874 old-squaws were of little value in describing the wintering population on Lake Michigan because of partial sex and age segregation of the birds. The four sex and age classes remain segregated as the population shifts up or down the lake depending on the severity of the winter season.

Weights were obtained from 2,558 ducks. Males, both juvenile and adult, were significantly heavier than females (.05 per cent level) in the months of November through May. Significant differences between all sex and age classes were shown for February and March. Variations between sex and age groups were remarkably constant. Weights reached a high in January and February, declined sharply in March, remained constant through April, and rose sharply in May.

An investigation of the breeding biology showed testicular volumes of adult and juvenile old-squaws to be significantly different in all months sampled. Juvenile ovaries showed no follicular development through May. Gonadal development indicates that old-squaw ducks do not become sexually active until two years of age. Adult female plumages may be separated into gray, intermediate and brown color phases. Oviduct weights of gray birds are significantly less than those of intermediate and brown birds. The color phases may be associated with age.

Animal material constituted 99 per cent by volume of all food in 151 old-squaw stomachs analyzed. The principal items were crustaceans (82.0 per cent), fish and fish eggs (12.5 per cent), mollusks (3.9 per cent) and vegetable food (1.1 per cent). Grit averaged 25 per cent of the total gullet and gizzard contents.

The key species linking the old-squaw to the gill-net fishery is the amphipod Pontoporeia affinis. This amphipod is the principal food of old-squaw ducks and Great Lakes whitefish. In view of this close relationship with ducks and fish dependent on a single food item, it is doubtful if any practical means can be devised to reduce gill-net mortality.

243 pages. \$3.15. Mic 56-3145

#### THE BIOLOGY AND ECOLOGY OF BUPRESTID BORERS ATTACKING HEMLOCK IN THE FLAMBEAU RIVER STATE FOREST

(Publication No. 17,316)

Ali Abdul Hussain, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor Roy Shenefelt

The hemlock borer (Melanophila fulvoguttata (Harr.)) attacks weakened and dying hemlock trees. The majority of these trees, though they were weakened, would have survived the adverse environmental conditions if they were not attacked by the hemlock borer. Weakened and dying hemlock trees in the open are also attacked by Chrysobothris scabripennis C. and G. The investigation reported here was undertaken to learn more about the life history, habits, and natural enemies of the buprestid borers, and to ascertain if the natural enemies in the Flambeau River State Forest are effective in keeping the population of the hemlock borer in check.

In order to determine the incubation period of the eggs

of the hemlock borer under natural conditions, bark scales on hemlock logs where the females of the hemlock borer were seen depositing eggs were removed carefully and when an egg mass was located, the scale was replaced and a small piece of paper pinned on both sides over it to hold the scale. Duplicates of pupal cells were engraved along the edge of a piece of hemlock bark, then one larva was placed in each cell and covered with a thin piece of bark and a black paper in order to study the duration of the prepupal and pupal stages. In preparing the life table for the hemlock borer, 221.3 square feet of bark taken from 72 infested standing and windthrown hemlock trees were examined. The numbers of first instar larval mines on each bark sample were counted and the number of mines that did not continue to the second instar larval mine was recorded under the factors responsible for the death of the first instar larva. The same method was used to determine the mortality of the other larval instars, pupa, adult, and egg stages.

The degree of infestation ranged from one to 30 larvae per square foot of bark. The eggs were laid under the bark scales from the second half of June until late in August. The incubation period under natural conditions was from eight to 12 days. The larva has five instars and the larval period may be ten to 10.5 months, but some larvae may have a larval period of 22 to 22.5 months. The total average length of the mine constructed by the larva was 32 cm. Winter was passed in the larval stage either in the pupal cell in the hard bark as a mature larva or in the feeding gallery as an immature larva. The pupal stage lasted from 27 to 33 days. Adults emerged from the first half of June until the first half of August. The hemlock borer has either a one-year life cycle or a two-year life cycle. Parasites of the hemlock borer and the real mortality due to activity of each were: 7.02% by Camptoptera sp., 21.14% by Atanycolus melanophili Shen., 8.56% by Odontaulacus bilobatus Prov., 1.81% by Spathius sp., and 2.28% by nematodes. The total real mortality caused by the parasites was 40.18%. Predators of the hemlock borer and the real mortality due to activity of each were: 11.02% by ants, and 11.08% by woodpeckers. The total real mortality caused by the predators was 22.10%. The real mortality of the hemlock borer caused by other factors was 15.22%.

The data gathered showed that the natural enemies of the hemlock borer (as far as they were studied) were far from being adequate to keep the population in check.

157 pages. \$2.10. Mic 56-3146

#### MOVEMENTS AND HOME RANGES OF THE WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) IN CENTRAL MISSOURI

(Publication No. 18,591)

Donald Robert Progulske, Ph.D.  
University of Missouri, 1956

Supervisor: T. S. Baskett

This study made from September, 1952 to May, 1956 reports on movements and home ranges of white-tailed deer on a 2,240-acre wildlife refuge in central Missouri.

Deer were live-trapped and marked for individual recognition with ear tags, bells, and collars. A new type

of collar with colored plastic designs attached to leather was developed during this study.

One hundred eighty-six records of movement were obtained for twenty-eight tagged deer and two others with natural markings. The greatest number of records was 30, obtained both for a male and for a female.

Home range diameters were derived by measuring on maps the distances between the two most widely separated points of observation. Extreme distances were 130 and 9,240 yards. When obviously long movements were excluded, home range diameters varied from 1,060 to 5,450 yards for deer observed five times or more. Home range diameters for does and fawns averaged 1,680 yards and for adult bucks averaged 2,800 yards. This average for all deer was 2,280 yards, or about one and one-fourth miles.

Another measure of home range was obtained for deer observed at least three times by connecting the outermost points of observation on maps, and measuring the enclosed area. These "minimum home ranges" varied from 10 acres for a deer observed three times to 1,920 acres for one observed 26 times. The average minimum home range for does and fawns was 210 acres, for adult bucks, 420 acres. For all deer minimum home ranges averaged 310 acres or about one-half square mile.

Despite the larger average home range diameters and minimum home ranges for males, there appeared to be no consistent difference in mobility of the sexes. Both males and females were reported several miles from the trapping sites, and the most sedentary animal observed was a male.

Sixteen of the 28 marked deer were seen off the 2,240-acre refuge area during the study; 151 observations of these marked animals were made on the area, and 35 observations were made off the area.

The best information obtained was for seasonal rather than annual ranges. During spring, summer, and part of the fall some deer seemed to have small and distinct home ranges from which they apparently departed in winter.

Daily movements of deer were determined during the winter when snow was favorable for tracking. Some winter groups remained for several days within areas less than one-half square mile while others moved about in considerably larger areas. One marked deer traveled 2 1/2 miles (air line distance) from one afternoon to midmorning the following day.

Deer of the study area were often harassed by hounds. Records of all hound chases were made for 20 consecutive months. The peak number of chases was in December, with a secondary peak in May. The former was attributed mainly to the raccoon hunting season, the latter to conditions favorable for fox hunting. Chases were of medium frequency during the peak of the deer fawning season.

The greatest average number of chases occurred on Saturdays, showing that many of the hounds were not strictly free-running but were taken on hunts by their owners. Very few hounds caught were collarless, indicating that most were not strays.

In nearly all instances hounds observed chasing deer were far behind them. Only one deer, an adult doe, was reported to have been killed by hounds.

86 pages. \$1.50. Mic 56-3147

## AGRICULTURE, PLANT CULTURE

### THE EFFECTS OF CHLORINATED HYDROCARBON INSECTICIDES ON THE FLAVOR OF VEGETABLES

(Publication No. 17,300)

John James Birdsall, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Kenneth G. Weckel

The harmful effects of benzene hexachloride on the flavor and odor of potatoes was reported as early as 1947, when it was applied for wireworm control in New Jersey. Since then, increased emphasis has been placed on the effects of BHC and other synthetic organic insecticides on the quality of fruits and vegetables. A four year study designed to screen a group of chlorinated hydrocarbon insecticides for their possible effects on the flavor of various vegetable crops is herewith reported.

The vegetables were grown in Kenosha County, Wisconsin on land not previously treated with insecticides. Permanent plots were designated in 1952 and were retained until 1954, with the same insecticides applied each year to specific plots. Applications to the soil and foliage were made at two rates for each of the seven insecticides tested. The lower rate of application represented a normal treatment while the higher rate was four times normal. Untreated check plots were included for comparison. Each of the eleven vegetables investigated was subjected to the insecticide treatments in each of two years, under varying climatic conditions. Soil treatments were applied just before planting and foliage applications were made approximately one month after emergence and continued at specified intervals until one month before harvest. Soil samples were taken from all plots for residual chemical analysis in each year. Residue analyses were also made on fresh vegetables at harvest. Samples for flavor analysis were transported to Madison and kept at 50 degrees F. until evaluated and/or processed. The triangulation procedure was used in all flavor evaluations. All vegetables treated with heavy applications of the insecticides were tested for flavor changes. If changes in flavor were apparent, evaluations were also made of vegetables treated at the normal rate.

Applications of insecticides to the vegetable foliage caused changes in flavor as follows: aldrin - canned pumpkin, cooked rutabagas, cooked cabbage; dieldrin - canned pumpkin; endrin - canned beets, canned squash, cooked rutabagas; chlordane - canned onions, canned pumpkin, cooked onions, raw carrots; heptachlor - canned beets; lindane - canned beets, sauerkraut, potatoes and squash, cooked rutabagas, raw radishes; and toxaphene - cooked onions. Applications of insecticides to the soils in which the vegetables were grown caused the following changes in flavor: aldrin - canned sauerkraut, cooked rutabagas; dieldrin - canned squash, cooked rutabagas; endrin - canned beets, sauerkraut, squash and pumpkin, cooked rutabagas; chlordane - canned potatoes, canned pumpkin; heptachlor - canned sauerkraut, canned pumpkin; lindane - canned beets, sauerkraut, carrots, onions and potatoes, cooked rutabagas, onions and potatoes, and raw radishes and cucumbers; and toxaphene - cooked rutabagas, onions and carrots.

On the basis of these results, there are certain general trends of economic interest. It appears that canning of treated vegetables results in a decrease in quality not apparent when similar samples are evaluated in the cooked or raw forms. Certain vegetables (snap beans, tomatoes, carrots, cucumbers) seem to be resistant to flavor changes due to insecticide treatments while others (squash, pumpkin, beets, rutabagas) are more susceptible. Generally, soil treatments had a more pronounced effect upon the flavor properties of the vegetables than did foliage treatments. Some definite changes in the flavor of the treated vegetables did occur during storage, especially when canned. Changes in flavor due to insecticide treatments were not always undesirable. Color variations did occur in the yellow, carotenoid-containing vegetables as well as in beets. Alterations of flavor and color could not be definitely associated with chemical residues in the treated vegetables.

132 pages. \$1.75. Mic 56-3148

#### A COMPARISON OF THE ETHEL AND WALKER VARIETIES AS PARENTS IN BLUEBERRY BREEDING

(Publication No. 18,778)

William Thomas Brightwell, Ph.D.  
The Ohio State University, 1956

A study of fruit cluster, fruit, and plant characters was made of progenies from crosses of the Ethel and Walker varieties of rabbiteye blueberry (*Vaccinium ashei* Reade). The fruit cluster characters studied were the number of clusters three inches or longer per plant, cluster compactness, and fruit location. The fruit characters observed were color, size, season of ripening, scar, flavor, aromatic flavor, number of seeds, and size of seeds. The plant characters studied were yield, height of plants, and spread of plants. The progenies studied were those with rabbiteye blueberry varieties Callaway, Myers, and selection 11-180; a selection from the cross *V. constablaei* x *V. ashei*; and selection BM 22 of highbush blueberry (*V. austrole* Small).

Hybrid plants used in the study resulted from pollinations made in the greenhouses of the United States Department of Agriculture at Beltsville, Maryland. The seeds were germinated, and the plants were potted and grown for one season before being shipped to the Georgia Coastal Plain Experiment Station, Tifton, Georgia.

Fifty plants from each progeny were studied, except in the case of the cross Ethel x Callaway, of which twenty-nine plants were examined.

Data were recorded on each plant in the 1952 and 1953 seasons and summarized in twenty-seven tables.

The Walker averaged 1 to 3 long fruit clusters per plant as compared with none for the Ethel variety. There was no correlation between cluster compactness of the parents and the progenies studied.

Fruit color was determined by reference to a Munsell PB 5.0 color chart. More seedlings from the Ethel produced light-blue fruits than from the Walker. Dark-blue color was partially dominant in crosses of the rabbiteye blueberry, and is controlled by cumulative genes. No linkage between the factors for fruit color and yield were noted.

Fruit size was largest in progenies of the largest-fruited parents. These data indicated no linkage between genes for fruit size and yield. Plants producing berries of the same size were found in various yield classes, and the converse was true.

Progenies from a cross with Ethel had as high a percentage as those from a cross with Walker, or higher, of plants with a small dry scar (point of separation of fruit and pedicel).

No difference was noted in season of ripening. In some crosses, progenies of Walker matured a higher percentage of the total yield of berries early in the season, while in others, progenies of Ethel did. The average seed number was larger in berries produced by progenies of Ethel than it was in those produced by progenies of Walker. However, average weight per seed was less in progenies of Ethel than in those of Walker.

With bushes the age of these seedlings, there was no correlation between yield and plant size. The largest plants did not produce the largest yield of fruit.

In general, the Ethel is superior to the Walker as a parent in breeding blueberries for the Southeast. Progenies from crosses of Ethel had a higher average yield per plant, larger berries, lighter-blue fruits, and a higher percentage of plants producing berries with small and dry scar than progenies from crosses of Walker.

97 pages. \$1.50. Mic 56-3149

#### THE EFFECT OF SOIL MOISTURE TENSIONS AND WATER TABLE ON GROWTH OF THREE FORAGE SPECIES

(Publication No. 17,996)

William Best Gilbert, Ph.D.  
North Carolina State College, 1956

Supervisor: Douglas Scales Chamblee

The effect of moisture tensions, depth of water table, aeration, inundation, and moisture removal at various depths were studied on ladino clover, orchard grass, and tall fescue.

A greenhouse study on the effect of submersion on seedling and mature plants in cool (65° F.) and warm (90° F.) water was conducted. Submersion in the warm water killed established ladino clover in approximately 12 days, severely damaged orchard grass in 6 days, and caused moderate to severe damage to tall fescue after 12 days submersion. Established ladino clover was moderately damaged by partial submersion in cool water for 30 days and the grasses for a longer period with minor damage. Seedling plants were more susceptible to injury than mature plants.

A greenhouse study was conducted on the effect of four levels of soil moisture availability on the yield of the three forage species. Ladino clover had the highest yield when the soil was kept above 75% available water level, with the yield progressively declining when the moisture content was reduced before being irrigated. Orchard grass and tall fescue yields remained fairly constant at the three shorter intervals before irrigation, with the yields from plants allowed to wilt approaching a significant difference.

The effect of depths of water table on the three species was studied in the greenhouse with and without surface watering of 1" per week. Without surface watering, ladino clover produced more forage than either of the grasses, with the water table at 6 inches having the highest yield, and the average of the yields from water tables at 12 and 20 inches being 17% lower. Orchard grass and tall fescue also had higher yields from the 6 inch water tables, but the average of the yields from the lower water tables was lower by 35% and 41% respectively. Aeration of the 6 inch water table had no effect on the clover yields.

From additional surface watering, a decided increase in grass yields was obtained from the lower water tables, with a depression of yields from the treatments with the water tables at 6 inches. Ladino clover had a slight increase from the extra surface water from all water table depths, but aeration depressed the yield.

In a field experiment using pure ladino and mixtures of ladino-orchard grass and ladino-tall fescue, water was supplied when the available soil moisture had been depleted in various soil zones as determined by nylon-metal electrical resistance blocks.

Following irrigation, approximately four days were required for the ladino and mixtures to deplete the available moisture to the 75% level, and an additional four days for the available moisture to be depleted to the 25% level.

Irrigation caused a decided increase in yields of ladino clover during periods of drought, with less response in mid-summer. Irrigation of the mixtures increased the growth of the clover more than the growth of the grasses.

107 pages. \$1.50. Mic 56-3150

5. Blind apices were found from the time of petal primordia up to and including pistil formation.  
56 pages. \$1.50. Mic 56-3151

#### I. LIME AND FERTILIZER INCORPORATION IN SPENCER SOILS FOR ALFALFA PRODUCTION.

#### II. DOWNWARD MOVEMENT OF CALCIUM, MAGNESIUM, AND POTASSIUM IN SPENCER, ALMENA, AND ANTIGO SILT LOAM SOILS UNDER FIELD CONDITIONS.

(Publication No. 19,113)

James Ramon Love, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor L. E. Engelbert

I. Research has shown the need for heavy liming and fertilizing if good yields of high quality alfalfa are to be grown on Spencer soils of north-central Wisconsin. Although it is usually recommended when applying these heavy amounts of lime and fertilizer that half the application be applied before and half after plowing, the questions have been raised as to how successfully alfalfa can be grown when all the lime and fertilizer are applied at one time and whether it is better to apply all before or after plowing.

To answer these questions a field study was conducted on Spencer silt loam where 5 tons lime and 1,000 pounds 0-10-30 per acre were applied by different methods. The results obtained may be summarized as follows:

All lime applied before plowing gave a distribution of lime in the plow layer, as indicated by the pH of various depths, more closely approximating that of split application than did the method of applying all lime after plowing.

Regardless of method of incorporation, the potassium content of surface two inches of soil sampled in the fall of the seeding year was two to four times higher than that in any succeeding two-inch depth of the plow layer. However, the effect of method of incorporation on distribution of phosphorus in the plow layer was similar to that of lime.

Stand counts of alfalfa taken in the spring of second hay year showed no differences due to method of lime and fertilizer incorporation.

Chemical analyses of alfalfa from both cuts of the first two years of hay revealed no differences in composition due to method of lime and fertilizer incorporation.

Total yields of alfalfa-brome hay for three years indicated no difference between split application method and that of applying all the lime and fertilizer before plowing. However a decrease of one-fourth ton hay per acre per year resulted when all the lime and fertilizer was applied after plowing.

II. The effect of heavy applications of lime and fertilizer on the downward movement of calcium, magnesium, and potassium under actual field conditions was studied on three soils of the Spencer area in north-central Wisconsin. The results obtained from these studies may be summarized as follows:

Evidence for calcium and magnesium movement during an 8 to 10 year period was found only when lime and

#### DEVELOPMENTAL ANATOMY OF THE STEM APEX OF THE BETTER TIMES ROSE

(Publication No. 18,807)

Richard Stadden Lindstrom, Ph.D.  
The Ohio State University, 1956

The greenhouse rose is considered the most important cut flower crop in the United States. One of the factors which reduces the rose grower's profit is blindwood, which is an abortion of the rose flower bud. The study was concerned with the reinvestigation of the anatomical aspects of blindwood, and determines those steps which lead to flower abortion of the hybrid tea greenhouse rose, Better Times.

For thirty-five days during part of March and April of 1951, samples of terminal and axillary buds were taken and prepared for microscopic examination.

The following results were obtained from the study:

1. The transition from the vegetative to the reproductive stage was considered to be the flattening of the apical meristem.
2. The first sign of abortion of the apex was disintegration of cells in the sepals or sepals and petals.
3. The next stage in the abortion of the bud was characterized by the appearance of necrotic bands in the sepals or sepals and petals.
4. The final stage was the appearance of an abscission layer in the stem below the pistil primordia.

fertilizer were used in the same treatment. Possible factors involved in the interaction of lime and fertilizer are: 1) Potassium went on the exchange displacing hydrogen as well as calcium and magnesium. The HCl thus formed resulted in a more rapid solution of the lime. 2) The calcium and magnesium chlorides formed, some of which would stay in the soil solution, were more easily leached than the more insoluble carbonate forms.

Significant increases in amounts of calcium and magnesium were found in the 10-14 inch depth in all of the high fertility limed plots. Calculations reveal that it would have taken about 40 to 350 pounds of dolomitic limestone per acre, respectively, to have replaced the calcium and magnesium annually leached from the plow layer in the plots showing the least and greatest movement.

The downward movement of potassium was noted in only one study and then only to a very limited depth in the subsoil. Also, there was evidence in the same field of a decrease in available potassium at depths below 14 inches where heavy amounts of lime and fertilizer were applied. It is concluded that better stands of alfalfa induced by the liming and fertilizing resulted in greater subsoil feeding. This indicates that movement of calcium and magnesium as well as potassium was probably greater than noted but was partially offset by subsoil feeding.

76 pages. \$1.50. Mic 56-3152

#### EFFECT OF HUMUS OF DIFFERENT ORIGIN IN MODERATING THE TOXICITY OF BIOCIDES

(Publication No. 17,325)

Donald Lewis Mader, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor S. A. Wilde

This study was concerned with effects of humus of different origin on the properties of soils treated with allyl alcohol, stoddard oil, chlordane, benzene hexachloride, calomel, thiosan, and formaldehyde. The results of treatments were judged on the basis of availability of nutrients, activity of beneficial soil organisms, and quality of produced nursery stock. Biologically active types of humus, carrying a high supply of energy material and possessing high exchange capacity, were found to be the most efficient in counteracting the adverse effects of biocides. Arthropod fine mull and matted mycelial mor humus types received primary attention.

The deteriorating effect of eradicants in high concentrations was expressed in reduced survival, unbalanced uptake of nutrients, and suppressed or unduly stimulated growth of plants. Applications of fertilizers to biocide treated soils had a tendency to increase toxicity of soil and otherwise magnify the adverse effects of eradicants.

Additions of humus counteracted the harmful influences of biocides and were especially beneficial on biocide treated soils that also received heavy applications of fertilizers. Humus in the solid form was more efficient than liquid humates, especially as regards survival and retarded growth of seedlings. Although humus material produced by arthropods usually proved to be most satisfactory, the efficiency of humus types varied with the biocides applied.

Nutrient composition of tissues was almost always altered by the biocide treatments. Nitrogen uptake was stimulated, particularly by treatments including thiosan. Assimilation of calcium and magnesium was generally reduced, especially by chlordane and calomel. Potassium content ordinarily increased as calcium declined, but, at times, its uptake was also reduced in the presence of biocides. With a few exceptions the uptake of phosphorus was not influenced.

Biologically active mycelial mor or arthropod coprogenous humus in solid form moderated the adverse effects of biocides on assimilation of nutrients; however, some discrepancies in the nutrient ratios of plant tissues were not corrected.

Most of the biocide treatments produced radical changes in activity of micro-organisms. Development of nodules in black locust and mycorrhizae in Monterey pine was either suppressed or even prevented by certain treatments, an effect which was seldom altered by the introduction of humus.

Growth of *Aspergillus niger* in nutrient solution was suppressed or retarded by allyl alcohol, formaldehyde, thiosan, calomel, and chlordane. Liquid humates, however, alleviated this condition in most cases. Cellulose decomposition was retarded in the presence of biocides and only slight stimulation of cellulose-decomposing activity was induced by additions of humus.

This study revealed that biocides when used in high concentrations for the control of harmful insects, parasitic fungi, and noxious weeds are harmful to the production of nursery stock. Such chemicals decrease availability of nutrients, suppress the activity of beneficial micro-organisms, disrupt the metabolism of seedlings, and produce seedlings with an unbalanced ratio of nutrient elements and an abnormal physiological make-up. These adverse effects are progressively increased as residues of biocides accumulate. Unequal distribution and subsequent high local concentrations of chemicals is also an important condition aggravating the effects of biocides.

The recovery of soil fertility and vigor of stock by application of humus varies considerably depending on the composition of the soil, biocides used, rate of application, and type of nursery stock. Nevertheless, the application of specific types of humus material in either solid form or as a suspension, is at present the only practicable means of improving the vigor of nursery stock produced on biocide treated soils.

81 pages. \$1.50. Mic 56-3153

#### RESPONSES OF ALFALFA (*MEDICAGO SATIVA L.*) TO GROWTH REGULATORS IN COMBINATION WITH DIFFERENT SYSTEMS OF MANAGEMENT

(Publication No. 17,327)

Martin Andrew Massengale, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor John T. Medler

Alfalfa is the most important forage plant in Wisconsin. A large acreage is established each year, and a supply of locally grown seed is desirable but is not generally

available. The effect of several different weather factors and management systems on seed yields have been studied, but very little has been reported concerning the effect of growth-regulating chemicals on alfalfa.

Field experiments were conducted in 1953, 1954, and 1955 to study the response of alfalfa to treatment with growth regulators used in conjunction with different systems of management. A greenhouse experiment was also conducted in 1955.

Plant growth regulators used were as follows:

2,4-dichlorophenoxyacetic acid	(2,4-D)
2,4,5-trichlorophenoxyacetic acid	(2,4,5-T)
Alpha naphthaleneacetic acid	(ANA)
Indole-acetic acid	(IAA)
2,3,5-triiodobenzoic acid	(TIBA)
N-phenyl phthalamic acid	(8Q6)
N-meta-tolyl phthalamic acid	(7R5)
2,4-dichlorophenyl acrylic acid	(B-409)
Maleic hydrazide	(MH)

The response to treatments was determined by yields of forage and seed, botanical composition, height of plants, and general observations.

Results showed that the yields of first-growth forage were always greater than those of the second growth. Certain pre-harvest clipping treatments lowered the yields significantly. Pre-clipping to 3 inches lowered yields significantly over all harvests while pre-clipping to 6 inches lowered the yields significantly only in the second harvest of one experiment.

Spraying with growth regulators did not significantly alter the yield of forage when measured in pounds of dry weight per acre except in one instance where treatment with 2,4,5-T had thinned the stand.

MH inhibited the growth of quack grass in only one experiment, and the regrowth in this case was not affected. 2,4-D and 2,4,5-T affected alfalfa more than the grass in all experiments.

The percentage of alfalfa was greater in the second growth than in the first. In pre-clipped forage, the lowest percent alfalfa in first growth was in plots pre-clipped to 6 inches and in plots pre-clipped to 3 inches in the second growth.

Spraying with all growth regulators except 8Q6, 7R5, and B-409 significantly reduced the height of alfalfa plants at one or more dates of measurement.

Yields of alfalfa seed were greater in 1953 and 1955 than in 1954. Yields from first crop growing in broadcast stand were greater than yields from second crop in 1954, but this was reversed in 1955.

In the first growth, alfalfa pre-clipped at different heights consistently produced more seed, but differences in yield were not significant. In the second growth, pre-clipping to both 6 and 3 inches significantly reduced yields.

Treatment with 2,4-D, 2,4,5-T, ANA, IAA, TIBA, 8Q6, and MH significantly lowered the yields of alfalfa seed in some experiments but not in others. This variable response of plants can probably be accounted for by differences in stage of growth and weather conditions at the time of spraying and the difference in concentration among growth regulators.

All growth regulators used except 7R5, 8Q6, and B-409 produced epinasty of the young internodes. In most cases, plants sprayed with TIBA lost apical dominance temporarily, and axillary buds developed into short branches bear-

ing small and narrow leaves. Alfalfa sprayed with MH or ANA was delayed in maturity, and there was less lodging in some experiments. 2,4-D, 2,4,5-T, and MH produced a yellowing of foliage in almost all experiments, and 2,4-D, 2,4,5-T, ANA, and TIBA applied to blooming plants caused drying, browning, and dropping of many flowers.

In the greenhouse experiment, the response of alfalfa to growth regulators was measured under daylengths of 12 and 14 hours. The results showed that those plants growing under 14 hours of light grew taller, had longer internodes, and flowered more profusely.

Spraying with 2,4,5-T, TIBA, ANA, and IAA significantly influenced height and the length of internodes at one or more dates of measurement.

There was no difference in the number of internodes per stem or the number of nodes to the first flowering raceme between plants grown under different photoperiods, or between plants sprayed with different growth regulators if the heights were averaged over both photoperiods.

166 pages. \$2.20. Mic 56-3154

#### PHOSPHORUS STUDIES ON CERTAIN NORTH CAROLINA SOILS

(Publication No. 18,001)

James NeSmith, Ph.D.  
North Carolina State College, 1956

Supervisor: Nathaniel Terry Coleman

Greenhouse experiments with Rabun, Cecil, Alamance, and Norfolk soils showed "A"-value to be relatively constant at low rates of phosphate application and to increase substantially at higher rates. From yield of phosphorus curves, a-values were calculated. At the higher rates of phosphate fertilization the percentage utilization of added phosphorus by the plants was not independent of rate.

Calculated "indices of fixation" generally agreed with the known characteristics of the soils with regard to phosphate fixation.

Study of Rates of Reaction of added phosphate with soils showed the initial rapid fixation to be essentially complete in four days. The subsequent slow fixation apparently was not complete at the end of 72 days.

A-values increased with levels of soil phosphorus, but the extent of increase was not the same for all soils or all rates of phosphorus.

Extraction studies showed the specific activity of the Bray No. 1 and HCl-H<sub>2</sub>SO<sub>4</sub> soil extract to nearly match the specific activity of the plants, indicating that the plants and extracting reagents removed the same type of soil phosphorus. P dissolved by the HCl-H<sub>2</sub>SO<sub>4</sub>, Bray No. 1, and sodium bicarbonate extractants were found to be equally well correlated with plant yields and phosphorus yields.

It was found that halloysite was more readily attached by 1M phosphate solutions than was kaolinite. The reaction was more rapid at pH 3.0 than at pH 7.0. Thermal curves and chemical analyses of the resulting products indicated different compounds were formed at the different pH values.

Extraction experiments with EDTA showed both iron and aluminum oxides to be responsible for phosphate retention, with aluminum apparently retaining the most.

Phosphorus fixation studies with clay from which iron and aluminum had been removed showed that pretreatment had considerable effect on the quantities of phosphate retained. Alkaline treatment to remove aluminum apparently had an activating effect so far as P fixation was concerned.

In general the four soils studied fixed phosphorus at different rates and probably by two different mechanisms. Aluminum oxides were found to be more reactive than iron oxides with regard to phosphate retention in soils. The clay mineral itself also appeared to be a factor in fixation.

125 pages. \$1.70. Mic 56-3155

**THE VALUE OF FIELD APPLICATION OF FUNGICIDES FOR REDUCTION OF POST-HARVEST TOMATO ANTHRACNOSE LOSSES**

(Publication No. 18,867)

Eugene Neil Pelletier, Ph.D.  
Purdue University, 1956

Major Professor: Eric G. Sharvelle

Tomato anthracnose is one of the most destructive tomato fruit diseases in the United States. Chemical control has not been completely satisfactory. Four aspects of chemical control are presented: the extent to which standard fungicides control post-harvest breakdown; laboratory bioassay of fungicides against the causal organism; field evaluation of new materials as selected by laboratory assay; and the influence of temperature on stability of fungicides.

To obtain more complete differential among fungicide field treatments, fruit samples from fungicide spray trials were stored at 45° F. where anthracnose could approach its maximum development. Weekly examination of stored fruit for percentage fruit infection gave data which were subjected to analyses of variance. Such data were obtained from spray trials over a three year period. In 2 years' results, Manzate and a mixture of Tri-Basic Copper and ziram were the most effective treatments; low soluble coppers gave poor control, and 7-day interval treatments were more effective than 14-day treatments. In the third year's trials several materials which were found promising through laboratory assays were equivalent to Manzate in control.

Extending the time between final spray application and harvest resulted in an increased percentage of anthracnose. Preharvest fungicidal treatments influenced subsequent rates of anthracnose lesion development in storage. Studies of anthracnose development in storage suggested that delay in lesion development is an important phase of chemical control and implies that some of the fungicides might have exerted a mild systemic effect. In this respect the ethylenedithiocarbamates were more effective than dimethyldithiocarbamates.

Direct laboratory bioassay of 29 standard fungicides, 28 experimental chemicals, and 19 antibiotics revealed several materials more effective than the best field treatment. The field efficiency of certain fungicides was not always correlated with laboratory efficiency. The effect of temperature on reduced efficiency was found to be partially responsible. With the materials tested, an exposure of 7

days to 97° F. reduced effectiveness by factors ranging from 0 to 8. 96 pages. \$1.50. Mic 56-3156

**SOME PHYSIOLOGICAL AND CHEMICAL CHANGES IN PEANUTS AFFECTED BY FRUIT DEVELOPMENT AND THE LEVEL OF NUTRIENT ELEMENTS**

(Publication No. 18,004)

Preston Harding Reid, Ph.D.  
North Carolina State College, 1956

Supervisor: E. T. York, Jr.

Investigations were made of the growth and fruiting habits of peanuts and of the effect which the development of fruit has upon subsequent flower, peg, pod and seed production. The mineral composition of peanut plants was studied throughout the growth of plants in which the fruiting cycle was interrupted after the production of flowers, pegs and pods. These results were compared with plants which were grown under conditions to produce the maximum amount of seed. Further studies were made of the effect of nutrient deficiencies on the growth and fruit development of the peanuts. The deficiency symptoms for all of the known essential elements except copper, molybdenum and chlorine were described.

The effects of rates of nitrogen, calcium and boron and of the source of nitrogen on peanut production and the mineral composition of the plants were also investigated. The possible effects of chlorine in the substrate were considered.

Growth of the plants and flower and peg production was greater on those plants which produced no pegs than those which produced maximum seed. Plants which produced no pods or only a small amount of seed were intermediate between the two extremes in growth and flower and peg production. Seed development on one side of the plant did not reduce flower and peg production on the opposite side on which pod development was limited by lack of calcium.

Nitrogen, phosphorus, magnesium, iron and aluminum levels of the leaves were lower in those plants which produced maximum seed, presumably due to the translocation of the elements to the seed. Calcium, potassium and manganese levels were highest in the plants which developed the most pods, possibly as a result of absorption through the pegs.

When pod and seed development were limited by calcium deficiency in the fruiting zone, flower and peg production were higher but pod production was lower than the plants which received an adequate supply of calcium in the fruiting zone.

Nitrogen, potassium, calcium, magnesium and boron deficiency symptoms developed rapidly when withheld from the substrate at any stage of plant growth. Symptoms of deficiencies of all other elements developed slowly or not at all on those plants which were supplied with the elements until the early stages of flowering.

Boron deficiency when very severe prevented flower formation. Less severe deficiency resulted in flowers being produced but no pegs being formed. Nitrogen, potassium, calcium and magnesium deficiencies resulted in

early death of the plants when none was applied. When the same elements were withheld after flowering had started fruit development was decreased greatly. Calcium and nitrogen deficient plants produced no pods.

Plants failed to grow as well when supplied ammoniacal rather than nitrate nitrogen. When the nitrogen was supplied as one-half nitrate and one-half ammonium, nitrogen uptake was greater but plant growth and fruit development were less than when all nitrate nitrogen was applied. Increasing the concentration of ammonium nitrogen in the substrate, increased potassium and phosphorus levels of the leaves but decreased calcium and magnesium levels.

183 pages. \$2.40. Mic 56-3157

**HERBICIDE STUDIES: I. THE RELATION OF  
2,4-DICHLOROPHOXYACETIC ACID TO  
pH AND ORGANIC MATTER OF SOILS.  
II. ALPHA-ALPHA-DICHLOROPROPIONIC ACID  
AND 3-AMINO-1,2,4-TRIAZOLE AS  
HERBICIDES ON JOHNSONGRASS.**

(Publication No. 18,820)

Edward Lee Robinson, Ph.D.  
The Ohio State University, 1956

I. Laboratory studies were made of various factors influencing the adsorption, leaching, and availability in the soil of 2,4-D as the alkanolamine salt and polypropylene glycol butyl ether ester.

Studies conducted on calcium bentonite, illite, and kaolinite clays showed that more long-chain ester of 2,4-D was held on the soil colloids than was the alkanolamine salt of 2,4-D. Both forms of 2,4-D appeared to be retained by each clay in relation to its specific surface. The greatest amount of 2,4-D was adsorbed by calcium bentonite, the next greatest by illite intermediate, and the least by kaolinite.

The effect of varying the amount of emulsifier and increasing the amount of oil on the adsorption of the long-chain ester of 2,4-D was investigated. The emulsifier had little influence on the adsorption of 2,4-D, but an increase in the amount of oil caused an increase in adsorption of ester.

Miami silt loam and Brookston silt loam, with or without their organic matter, adsorbed approximately equal amounts of both the amine salt and the long-chain ester. Both soils with their original organic matter adsorbed approximately twice as much of the long-chain ester as did the soils with organic matter removed.

The long-chain ester of 2,4-D applied to Miami silt loam was adsorbed 61.8, 54.1, 37.5, and 24.7 per cent at pH 5.4, 6.0, 6.8, and 7.6, respectively, but the amine salt of 2,4-D was adsorbed on samples of the same soils at approximately 30 per cent. Regardless of pH, most of the amine salt was leached through four inches of soil, but most of the ester was found in the top inch of a four-inch soil column.

On Brookston silt loam, with high organic matter, there was little difference in adsorption between the amine salt and ester at pH 6.0 or 8.0. On a peat soil at pH 5.0 and 7.0, about 24 per cent of the amine salt was adsorbed; 32 and 27 per cent, respectively, of the ester was adsorbed.

II. Studies were conducted on control of Johnsongrass with Amizol and dalapon.

Applications of Amizol at 4 and 8 pounds per acre and dalapon at 5 and 10 pounds per acre, followed by plowing, did not control Johnsongrass. However, three cultivations in addition to the herbicides gave excellent control of the grass. When applied one and two weeks before corn planting, Amizol did not damage corn, but dalapon injured corn severely.

A combination of 2 pounds Amizol and 8 pounds dalapon per acre, with plowing, and without cultivation, gave 87 per cent reduction in top growth when observed 4 months later.

Applications of herbicides were made three times, one week apart, on Johnsongrass in the flowering stage. Maleic hydrazide applied at 5 and 10 pounds per acre each time had no observable influence on Johnsongrass. Dalapon was applied at 5 and 10 pounds per acre each time. The heavier rate killed top growth completely. Amizol was applied at 4 and 8 pounds per acre each time. The heavier rate killed 90 per cent of the top growth.

109 pages. \$1.50. Mic 56-3158

**BACTERIAL BLIGHT OF LIMA BEAN**

(Publication No. 19,146)

Maung Mya Thaung, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor J. C. Walker

Since the information available as to the source of primary inoculum of the bacterial blight (*Pseudomonas syringae* van Hall) of lima bean (*Phaseolus limensis* Macf.) is insufficient to explain the spasmodic occurrence of the disease on an epidemic scale in Wisconsin, this study was undertaken.

The disease is seed-borne as well as soil-borne. Apparently, the pathogen did not survive in the soil in the absence of the host into the second crop year. Red clover (*Trifolium pratense* L.) is not regarded as a reservoir host in Wisconsin. The use of disease-free seeds together with sanitation and crop rotation practices may help to hold the disease in check.

The disease development was high at 28°, and 16° day-28° night treatments, and low at 16°, and 28° day-16° night treatments. The minimum and optimum temperatures for the growth of the incitant are 16° and 28° respectively.

Plants grown at 3 H, high N, low P, and low K gave high disease indices while those at 0.1 H, 0.3 H, 1 H, low N, high P, and high K showed no large differences in their indices. No correlation between the levels of either sugar or amino nitrogen in the leaves and the disease index was found.

Asparagin, used as the source of organic nitrogen for the pathogen in culture medium, was the deciding factor for growth and green fluorescent pigment production. Pigment production was independent of sucrose, and sucrose was of minor importance for the growth of the incitant.

43 pages. \$1.50. Mic 56-3159

**CROP SENSITIVITY TO ACCUMULATIONS  
IN THE SOIL OF INSECTICIDES  
EMPLOYED FOR COTTON INSECT CONTROL**  
(Publication No. 18,824)

John Gordon Watts, Ph.D.  
The Ohio State University, 1956

The accumulation of certain insecticides in the soil following extended commercial use poses a threat to the growth of sensitive crops. Complications such as this have occurred with arsenic in apple orchards and cotton fields. There have been numerous reports of experimentally induced injury to various crops from soil applications of several of the chlorinated hydrocarbon insecticides.

Corn, grain sorghum, soybean, and sweet potato are frequently grown in rotation with cotton. Each of these crops is, therefore, subjected to residue accumulations of the several insecticides commonly used for cotton insect control. Data are presented on these crops from two 5-year experiments, one a randomized block with four replicates and the other a split-plot design with six replicates. Aldrin, BHC, a mixture of BHC and DDT in a 3:5 ratio, chlordane, DDT, dieldrin, lindane, toxaphene, and parathion were applied to the soil in multiples of the rates in commercial use on cotton. One, five, and ten times the annual commercial rate of each was incorporated into the soil prior to spring planting. The different application schedules

produced information on both weathering and accumulation of residues over a period of from one to five years.

Residues from the commercial usage rate of organic insecticides for cotton insect control in the Southeast caused no measurable injury to corn, cotton, or soybean. Sweet potato and, especially, grain sorghum are highly sensitive to heavy soil residues of BHC. They may be injured if grown following cotton which has been treated with BHC over an extended period. Cotton and corn were the next most sensitive to BHC, and they were similar in response to residues of this insecticide. Soybean was tolerant of substantial quantities of BHC in the soil. At equal rates of gamma isomer, lindane was slightly less phytotoxic and considerably less persistent than technical BHC.

Each of the five crops was remarkably tolerant of aldrin, chlordane, and probably also dieldrin. The higher rates of DDT and toxaphene, when applied for four or five consecutive years, were injurious to some crops. Ten times the annual commercial rate of parathion applied for five successive years caused no injury.

Cantaloupe was highly sensitive to toxaphene, and less sensitive to lindane and technical BHC. Nut grass, Cyperus rotundus L., population increased about 50 per cent after two soil applications of 7.5 pounds per acre of gamma isomer from technical BHC (12 per cent gamma isomer).

None of the chlorinated hydrocarbon insecticides reduced germination when mixed with soil at about 20 tons per acre.

110 pages. \$1.50. Mic 56-3160

## ANATOMY

**OSCILLOSCOPIC STUDY OF THE  
CERVICAL VAGUS NERVE IN THE CAT**

(Publication No. 17,915)

Faye Eugene Doenges, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. E. W. Lowrance

Histological preparations made in the present study of the cat's nodose ganglion by Cajal's method 6 revealed, among other atypical formations, terminations similar to those reported by other investigators. In an attempt to explain the function of these terminations and to clarify some of the contradictory results found in the literature concerning related fields of investigation of the cervical vagus nerve, a detailed oscilloscopic study was made of the cervical vagus of the cat for a reflex through a decentralized nodose ganglion. Such a reflex would be in agreement with and an answer to most of the morphological and functional problems in the literature concerning the cervical vagus. The superior laryngeal branch of the vagus and vagus trunk below the ganglion were considered to be the most likely path for the reflex fibers.

Twelve adult cats were studied intensively in the definitive part of this oscilloscopic investigation. An additional 30 animals were utilized as supplementary controls and as specimens subjected to varied surgical approaches and basic procedures.

A DuMont oscilloscope with an Offner pre-amplifier supplemented with an audio unit was used with silver and suture-wrapped silver electrodes for recording changes in potential of the nerves. Non-polarizing silver electrodes were utilized to stimulate the nerves with single shocks of 1 msec. duration from a capacitor discharge stimulator. Each nerve was stimulated with voltages ranging from 0.2 to 5.4 r.m.s. volts. A square wave stimulator was employed in later experiments to confirm the results of the capacitor discharge stimulator. Controls showing normal conduction patterns of nerve fibers with known potential complexes were obtained from each animal. For some animals, controls were set up which demonstrated that the effect of the depth of pentobarbital anaesthesia on induced nerve impulses was imperceptible. The vagus trunk was cut above the nodose ganglion, and the superior cervical sympathetic ganglion with 1 to 2 cm. of its adjoining cervical trunk was removed in each experiment. The second rib was removed to provide access to the stellate ganglion. Stimulation of this ganglion was carried out to detect any fibers from the sympathetic trunk that might course to and up the vagus trunk and then out through the superior laryngeal branch of the vagus.

The superior laryngeal branch of the vagus nerve, either attached to the larynx or cut free from it, was stimulated and recordings were obtained from the vagus trunk 4 to 8 cm. below the decentralized ganglion. The records obtained showed that there was no change in potential in the fibers of the vagus trunk below the ganglion

following stimulation of the cut or intact superior laryngeal branch. The electrodes were reversed and recordings were made from the cut superior laryngeal branch following stimulation of the vagus trunk below the ganglion. The records showed no impulses conducted into the superior laryngeal branch. These results indicated that there was no reflex component in the nodose ganglion which passed through the vagus trunk below the ganglion and the superior laryngeal branch of the vagus.

In two of nine animals, repeated stimulation of the stellate ganglion was followed by impulses conducted in the cut superior laryngeal branch. The fibers stimulated in the stellate ganglion of these animals must have crossed to the vagus below the level to which the sympathetic trunk had been removed and above the level of the vagus at which recordings in the earlier part of these experiments had shown no impulses present following stimulation of the superior laryngeal branch of the vagus. Thus, occasionally a pathway was demonstrated to pass via the sympathetic trunk, subnodosal vagus and superior laryngeal nerve.

148 pages. \$1.95. Mic 56-3161

#### HISTOLOGICAL MODIFICATION OF THE MOUSE SUBMAXILLARY GLANDS INDUCED BY THYROXINE AND ANDROGEN

(Publication No. 18,913)

Cyril Edmund Luckman, Ph.D.

University of Illinois,  
Chicago Professional Colleges, 1956

Supervisor: Parke H. Simer

The submaxillary glands of male mice are characterized by relatively few alveoli and a preponderance of serous tubules which are tortuous, have an average diameter of 48 microns, and are rather uniformly filled with acidophilic granules. In female mice the serous tubules are relatively straight, have an average diameter of 34 microns and are almost devoid of granules. Alveoli are the predominant structures in the submaxillary glands of female mice. The tubule cells of female salivary glands have prominent basal striations which are lacking in male glands. Tubule cell nuclei are basal in male but central in female submaxillaries. The structural differences of the glands in the two sexes may be correlated with differences in their saliva.

The effects of thyroxine and testosterone on the submaxillary glands of mice of both sexes were studied. The submaxillary glands of immature males were precociously stimulated and those of young females were modified in a masculine direction at an early age by treatment with large doses of thyroxine. The glands of both sexes of animals responded equally and revealed large coalescent secretion granules within the serous tubule cells and increased serous tubule diameters. Serous tubules of 25 day old thyroxine treated mice were equivalent in diameter to those of 35 day old normal males and the diameters of the serous tubules in 45 day old treated animals corresponded to those of 60 day old normal males. Growth of the gonads and accessory sex glands of males was inhibited by the administration of thyroxine but the kidney weights were in-

creased in both sexes. Hypothyroidism, induced by treatment with 0.25 per cent propylthiouracil did not prevent the development of masculine characteristics in the submaxillary glands in growing male mice.

Castration produces involutionary changes in the submaxillary glands of adult male mice. These changes which consist of loss of granulation, decreased tubule diameter, acquisition of basal striations and change of nuclear position are conspicuous by 14 days and virtually complete by 28 days post castration. Hypothyroid male mice undergo these regressive changes at virtually the same rate and to the same extent as normal castrates. Seminal vesicle regression is not complete by 45 days post castration. Kidney weights in the hypothyroid males are consistently lower than those of the euthyroid males. No signs of submaxillary gland regression can be seen in intact adult males which were subjected to prolonged treatment with 0.25 per cent propylthiouracil.

Testosterone and thyroxine are shown to be about equally effective in stimulating the submaxillary glands of gonadectomized hypothyroid mice of both sexes. In four different experiments, involving more than 150 animals, each of these hormones, when used alone, produced highly significant degrees of stimulation of the submaxillary glands and the effect of the two hormones administered together was synergistic as judged by all the criteria used in this study. While thyroxine appears to have an effect on the submaxillary glands very similar to that of testosterone propionate the type of granules formed in response to thyroxine is distinctive and can be readily detected by microscopic examination. This difference is probably quantitative rather than qualitative and may be due to excessive stimulation of the tubule cells. Thyroxine produces a greater increase in kidney weights than does testosterone and the effect of the combined hormones is greater than the sum of the individual effects. A synergistic effect of the two hormones is also seen in the weight response of the seminal vesicles.

Female sex steroids and adrenal cortical hormones appear to be without effect on the submaxillary glands excepting for a slight increase in the degree of granulation of the serous tubule cells produced by the administration of progesterone. The submaxillary glands of pregnant animals are similar to those of virgin females.

The observed effects of thyroxine on the submaxillary glands may be explained by assuming that this hormone, in physiologic amounts, has a potentiating effect on the action of testosterone but that in the massive doses frequently employed it may precipitate a reaction in a delicately balanced biological system. Testosterone, on the other hand, is thought to have a specific action on the glandular epithelium.

115 pages. \$1.50. Mic 56-3162

**INTERPRETATION OF THE ELECTROMYOGRAM  
RECORDED FROM LEG MUSCLES OF  
NORMAL HUMAN SUBJECTS DURING GRADED  
VOLUNTARY MOVEMENTS OF THE FOOT**

(Publication No. 17,333)

Alice Louise O'Connell, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Otto A. Mortensen

**Introduction:**

Since the first electromyograms from normal human muscles were reported early in the 20th century, many investigators have concerned themselves with electromyography as a method of studying neuromuscular activity. This study is an investigation of the functioning of certain muscles of the leg during movements of the foot. The major areas are:

1. Interpretation of electrical activity recorded from muscles antagonistic to the movement performed.
2. Activity of leg muscles as prime movers.
3. A detailed study of the tibialis anterior muscle.

**Procedure:**

Electromyograms were recorded with an eight channel inkwriting Gilson electromyograph. The electrodes used included eight mm. silver discs, silver rods three mm. in diameter, insulated needles with bare tips and a coaxial needle.

The muscles studied were the tibialis anterior; peroneus longus, brevis and tertius; soleus; flexor and extensor digitorum longus. The subjects sat with the legs pendant.

**Results:**

1. Conventional electrodes recorded action potentials from anatomical antagonists. Reduction in size and in the distance between electrodes markedly reduced the amplitude of this electrical activity without modifying the electromyogram recorded from the muscle when it was a prime mover.

Larger potentials were recorded from needle electrodes than from surface electrodes when the muscle was a prime mover and less activity when the muscle was an antagonist. When the needle tips were one millimeter or less apart, little or no activity was recorded from a muscle which was anatomically antagonistic to the movement.

2. The tibialis anterior remained electrically silent during eversion until the movement was forced. At this point, single motor unit spikes appeared identical with the pattern recorded during the initial phase of dorsiflexion.

During inversion, the tibialis anterior is active only if the medial border of the foot is raised; otherwise the movement is apparently performed by posterior leg muscles.

The soleus muscle, described as an inverter of the foot, demonstrated partite activity, the lateral head being more active during eversion and the medial head during inversion. This was a relative rather than an absolute difference but was often quite striking.

3. Electromyograms were recorded from eight pairs of electrodes arranged longitudinally along the tibialis anterior muscle. Differences in the electromyograms from the proximal and distal portions of the muscle appear to correlate with differences in the arrangement of the underlying muscle fiber bundles.

In the proximal portion, individual motor unit activity was relatively localized to one or two channels. Fiber bundles in this area run downward and inward from the surface to the central tendon.

Motor units in the distal part of the muscle recorded approximately the same amplitude through several channels. In this region, many fibers lie entirely along the surface of the muscle.

More motor unit potentials of low amplitude, high frequency and low threshold were identified in the upper portion. Conversely, more unit spikes of high amplitude, low frequency and high threshold were identified in the distal region.

Electromyograms recorded during strong contraction showed a lower amplitude and higher frequency in the proximal part of the muscle.

**Conclusions:**

1. Electrical activity recorded from an anatomical antagonist does not necessarily represent contractile activity in that muscle. Such action potentials more likely represent a spread of potential from adjacent active muscle.
2. Electromyography has revealed phases of muscular behavior not previously observed by other methods of study.
3. It is postulated that a large number of small, low threshold, high frequency motor units are distributed through the proximal region of the tibialis anterior, while, conversely, more large units of high threshold and low frequency are distributed through the distal area.

136 pages. \$1.80. Mic 56-3163

**FETAL MEMBRANES OF  
THE CANADIAN PORCUPINE,  
ERETHIZON DORSATUM, LINNAEUS**

(Publication No. 19,127)

Carmie Ann Perrotta, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harland W. Mossman

This study of the anatomy of the uterus and fetal membranes from pre-implantation through post-partum stages of the Canadian porcupine, *Erethizon dorsatum*, (Linnaeus), was based on the examination of approximately 200 specimens grossly and 40 specimens microscopically. The uterus is transitional in type between duplex and simplex. The lumen is longer than the cornu due to its spiral course. The myometrium consists of an inner circular and a very edematous, outer longitudinal zone. Initial implantation is by an antimesometrial attachment cone with a mesometrially oriented embryonic disc. Implantation is partially interstitial, and amniogenesis probably occurs by cavitation. A complete decidua capsularis is formed, disappearing during the last half of gestation; the basalis is a narrow pedicle at term; the parietalis is zonary. Germ layer inversion is early as in the more highly specialized rodents. The vascular splanchnopleure develops branched villi in a broad zone near the placental disc. Distally, the bilaminar omphalopleure is absent by the embryonic shield stage, but proximally persists on the surface of the

placental disc. The mesometrially oriented ectoplacenta is characterized by compact trophoblast bordering a central excavation, trophoblastic canals feeding into the trophospongium and an extensive peripheral zone of trophoblastic giant cells. The definitive chorio-allantoic placenta is discoid, labyrinthine (with complex lobulation), and hemochorionic. A subplacenta is formed which degenerates

near term. The lobular labyrinth, subplacenta, peripheral giant cell zone, and villous yolk sac occurring in the porcupine are typical for those hystricomorphs (guinea pig, chinchilla, and agouti) whose fetal membranes have been studied. The lobular labyrinth and subplacenta are two of the most highly specialized fetal membrane characters occurring in the rodents.

166 pages. \$2.20. Mic 56-3164

## ANTHROPOLOGY

### THE ILLINOIS INDIANS, 1634-1800:

#### A STUDY IN DEPOPULATION

(Publication No. 17,938)

Emily Jane Blasingham, Ph.D.  
Indiana University, 1956

The Illinois Indians, an Algonquian-speaking group which formerly lived near the Illinois and Mississippi rivers in the present states of Illinois and Missouri, had a population of approximately 12,000 individuals in 1680, the date of inception of intensive European contact. After 120 years of intensive European contact and acculturation, the total population of the Illinois had declined to five percent (500 individuals) of what it had been in 1680. It is the purpose of this study to ascertain the causes of the rapid depopulation of this group. In order to accomplish this it was necessary to reconstruct the history of the Illinois (their relations both with other Indian groups and with the European powers dominant within their area) as well as those aspects of Illinois culture which would bear on this problem.

As a result of this study we find that the decline in population of the Illinois was caused by a number of factors, some of which were more important than others during the late seventeenth and early eighteenth centuries. Others were more influential during the last half of the eighteenth century.

Continual warfare was important in the depopulation of the Illinois throughout most of the period under consideration in this study. While large scale raids, such as the Iroquois raid of 1680, the Chickasaw, Shawnee and Kas-kinampo one of 1698 and the raid by the Fox and allied tribes in 1752 undoubtedly had a lasting effect upon the Illinois, it was the almost annual raids both by and on the Illinois which had the greater effect in persons killed and wounded, in the destruction of food and property, and on the morale of the group as a whole. Throughout the seventeenth and eighteenth centuries the Illinois persisted in their old village pattern of widely spaced houses; they never constructed compact, fortified villages. Instead, they relied on fortifications erected by the French and would take refuge in these, abandoning their homes, food-stuffs, and all their personal possessions to the raiders. This occurred in 1684 and again in 1752.

Of importance also during the first two or three generations after White contact was the conversion of most of the Illinois to Catholicism, which resulted in the decline of

polygynous marriages. According to all of the early writers, and there is no valid reason to distrust their statements, many Illinois had more than one wife prior to their conversion to Christianity. With the advent of monogamy, the total number of births in the next decade or so probably rapidly declined, the exact percent depending upon the amount of polygyny practiced prior to White contact and the degree of conversion to Christianity of the Illinois. Some of the resultant surplus of females married French traders and settlers, others were killed or captured in the raids of 1680 and 1698. The fate of the remainder is unknown.

Epidemics of measles and smallpox also served as depopulation agents. The epidemics of 1703-1704, 1714, 1732-1733 and 1757 had an especially heavy effect on the Indians of the western Great Lakes region. The presence of malaria in the Illinois country was not noted until after the British occupied the former French possession in southwestern Illinois in 1765. Besides the deaths which may have resulted among the Illinois from this disease, undoubtedly some Illinois suffered from the debilitating effects of malaria. Besides these three diseases noted in the contemporary sources, one, gonorrhea, was not mentioned by any seventeenth or eighteenth writer. It probably had a great effect on the population of the Illinois, not on the death rate itself but by lowering the birth rate, especially during the latter part of the eighteenth century when a higher birth rate was needed to repopulate a rapidly diminishing group.

Two other causes for the decline in the population of the Illinois were excessive drinking and the formation of splinter groups. Both of these, by necessity, occurred rather late in the period under discussion. The excessive consumption of liquor could only become a factor after the establishment of the colony of Louisiana and the resultant ease of supplying trade goods to the Illinois from Louisiana via the Mississippi River. While splinter groups had undoubtedly occurred throughout the history of the Illinois, their formation was a serious factor after the middle of the eighteenth century when the population of the Illinois had already considerably decreased from other causes.

150 pages. \$2.00. Mic 56-3165

A STUDY OF  
CENTRAL ANDEAN CERAMIC FIGURINES

(Publication No. 19,247)

Rose Muriel Lilien, Ph.D.  
Columbia University, 1956

Ceramic figurines were first made in the Central Andes during the Early Formative period, and are found in all later prehistoric periods to the Spanish conquest in 1532. They did not, however, have a continuous distribution in all parts of the Central Andes, and were, in fact, rare in the highland areas. Figurines were more popular in the cultures of the coastal valleys, especially after the introduction of the ceramic figurine mold.

All Central Andean figurines prior to the Florestal epoch were hand modeled. The north coast Florestal culture (Mochica) was the first to utilize the ceramic figurine mold in the Central Andes; both one and two-piece vertical molds were used to turn out solid and hollow figurines. By the end of the Fusional epoch both types had diffused southward along the coast, reaching most of the central coast valleys. The remaining southern portion of the central coast (from Lurín Valley southward) and the south coast valleys finally received the figurine mold during the Imperial epoch. They received only the simpler, one-piece mold, which they used to turn out solid, flat bodied figurines. All the coastal molded figurines are, however, stylistically closely interrelated, since they are ultimately derivable from the Mochica figurines. The highland Central Andean cultures apparently never adopted the ceramic figurine mold, and highland figurines during the entire prehistoric period are distinct from those of the coast.

Although many different types of figurines were made by the Central Andean cultures, they are a remarkably homogeneous lot. For the most part they represent stiff bodied, standing figures, with the legs together and the arms placed across the chest. They are lifeless figures; only rarely are they represented engaged in activities (e.g., holding babies, carrying bundles or a variety of other objects, playing a musical instrument, etc.). Occasionally pregnant females were represented; these are found mainly in the Nazca culture of the south coast or cultures influenced by the Nazcas. Central Andean figurines, in actuality, depict primarily females -- adults, children, or infants. Many of these are children, which could in part account for the static quality of the representation. The remainder of them are male figures (6.4 percent); sexless figures (4.5 percent); and infant figures whose sex could not be determined (1.9 percent).

Functionally most Central Andean figurines appear to have been children's dolls or toys. Certain of the figurines probably had special religious significance as fertility symbols or idols; others seem to have been used as "good luck pieces" or amulets.

The earliest Central Andean figurines (those associated with Early Guañape and Early Ancon remains) are stylistically reminiscent of the approximately contemporaneous (early Pre-Classic) figurines of the southern lowland portion of Meso-America, and probably were made in imitation of them. All later period Central Andean figurines seem to have been completely local or provincial in nature, showing no evidence of outside influence. They do, however, exhibit much local, intra-Central Andean mixture

since figurine traits and types diffused with relative ease up and down the Peruvian coastal area during most of the prehistoric period, and highland figurines, even from widely separated areas, resemble each other. Nevertheless, relationships between coastal and highland figurine types are not evident, and apparently the two complexes were always distinct.

497 pages. \$6.35. Mic 56-3166

THE EFFECT ON FAMILY STRUCTURE  
OF CHANGING ECONOMIC ACTIVITIES  
OF WOMEN IN A GOLD COAST TOWN

(Publication No. 19,250)

Daniel Francis McCall, Ph.D.  
Columbia University, 1956

The family is a system of interaction of a plurality of roles. If any of the roles change then the family structure has changed. The role under consideration is that of wife; the changes, in regard to subordination and fidelity, are functionally related to a change in women's economic activities - from farming to trading.

Chapter I shows that the "two disparate phases of culture" (the role of wife and economic activity) were interlocked in Akan society before the imposition of European control. This involves a certain amount of historical reconstruction and may be considered a minor thesis. Social stratification provided some variability but the majority of wives were subordinate to the husband and restricted to his prerogatives in their sexual outlets; their occupation as farmers made chaperonage feasible.

Chapter II shows that the same two phases are interlocked in contemporary Gold Coast towns, but now women are independent in their attitudes toward their husbands and adultery flourishes; trading gives them the conditions which make possible these alterations of traditional relationships.

Chapter III presents data on women traders obtained in interviews in a Gold Coast town in 1952.

Chapter IV offers the interpretation. Women were expected to be economically productive in Akan society and had fulfilled this expectation in the old days by farming. Some women, in rural areas, still do so. Town women find farming less available (because of distance to the fields or because they lack rights to local lands) so they turn from the fields to the market as a functional equivalent. Trading provides subsistence for themselves and their children but has certain effects that are dysfunctional in terms of the old family structure. Trading puts women's economic activities beyond the supervision of the husband; he could supervise the farming and dispense the harvested supplies, but trading depends upon knowledge of prices, seasons, and a variety of goods, etc., and trading is here a woman's world so that these things are a mystery to most men. He cannot interfere without jeopardizing his wife's success. She takes advantage of this by not remitting any of her profits to him; as a farmer she supported him as well as the rest of the family by her labor in the fields - now she supports only herself and her children. It is not the value of her economic activities that accounts for the women's place in a superordinate-subordinate

continuum, as many previous writers have suggested, but the factor of controllability of the product. Farming sometimes is as productive as trading.

Economic independence need not inevitably result in sexual freedom for the wife, but fidelity had been achieved in the past, not by inculcation of attitudes of shame or guilt but by chaperonage which cannot be effective under the conditions of trading. Furthermore, the idea of romantic love was, and is, largely unknown; sexual experience, rather than the personality of the lover, is the main focus.

Women did not consciously seek these changes in family relationships. They sought merely to replace one economic activity with a more convenient one but because family structure and occupational structure are interlocked these changes followed.

144 pages. \$1.90. Mic 56-3167

#### LITERACY PROMOTION IN AN UNDERDEVELOPED AREA

(Publication No. 18,445)

Alfred Goud Smith, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Prof. Charles William Merton Hart

This thesis analyzes the linguistic and ethnological methods of a specific program for promoting literacy in one underdeveloped area, the Trust Territory of the Pacific Islands. It aims to systematize the problems of the field of literacy promotion as a branch of applied anthropology, and to present new techniques and concepts that were developed in the Trust Territory.

This literacy program was a practical operation designed to meet the needs that arose from the contact between Micronesian and American cultures. Therefore, the introductory chapters analyze the nine culture areas in the territory; the American administration of the territory; how the administration recognized a literacy problem; how, in 1950, it recruited the author to help solve this problem; and how he organized and directed a program, working in and for the territory until 1953.

The body of the thesis gives a functional analysis of the program, which included six interdependent parts. The first part was planning. Its plans were formulated by considering three basic questions that arose from actual conditions: Literacy for whom? Literacy for what? And literacy in which language? By considering these questions the program formulated plans to promote literacy

among all of the Islanders, first in their own particular speech and then in English. It planned to change literacy rates, but not languages, speech, or anything else. Since the program had to deal with the complex groupings of local languages and dialects, and had to teach each Islander to read and write without changing or standardizing his particular language, the program developed the concept of a language continuum. This concept regarded local dialects as generally continuous transitions from one to another, without demarcating discrete dialect boundaries. Linguistic analyses were made of a selected focal dialect in each area, and the results of these analyses were then adapted to the other dialects in that area.

The second part of the program involved preliminary procedures which consisted of: taking a literacy census; making a survey of the languages and dialects spoken in the territory; and developing a program for promoting the conditions for literacy in those areas where literacy had little meaning for the people, and where, therefore, literacy itself could not be promoted effectively. Although the literacy census was planned in detail, it was never taken. A complete language survey was made; and a pre-literacy program was conducted, but it did not demonstrate conclusively that the concept of pre-literacy training is a valid one.

The third part of the program involved technical procedures which provided systems of writing for local languages that had not been written before. These writing systems included accurate and practical orthographies, and guides to punctuation, grammar, and usage. The development of these systems required adaptations of academic linguistic principles to meet the practical problems. The technical procedures also included introducing the systems of writing to the people, and adapting the system for the focal dialect of an area to the non-focal dialects.

The fourth part, operational procedures, involved teaching the people to use these systems of writing. This included the preparation of texts, the selection and training of teachers, providing for school facilities, and devising curricula and teaching methods.

The fifth part involved teaching the Islanders English as a second language, and teaching island languages to American administrators in the territory. The teaching of foreign languages in the island setting followed the same approach that was used in promoting literacy proper.

The sixth and final part involved evaluating the program through external evidence, such as follow-up surveys, and internal evidence, such as difficulties encountered in conducting the program. Although a follow-up survey could not be made, other kinds of objective evaluations provided specific suggestions for future literacy programs.

387 pages. \$4.95. Mic 56-3168

## BACTERIOLOGY

### INACTIVATION OF THE INFLUENZA VIRUS IN THE DRIED STATE BY LOW VOLTAGE ROENTGEN RAYS

(Publication No. 18,912)

Arthur Voelkel Kroeger, Ph.D.  
University of Illinois,  
Chicago Professional Colleges, 1956

Supervisor: J. E. Kempf

Techniques such as electron microscopy and hydrodynamic studies reveal only the over-all morphology of a virus particle, but they cannot relate biological function to any particular portion of the virus. Bombardment of viruses with various types of ionizing radiations has been used by many investigators to elucidate virus structure and function. The physical aspects of these radiation studies have been carefully controlled and perfected, but the important biological aspects have been given only slight consideration. Therefore, it was the purpose of this investigation to assess the relative importance of various biological factors on the radio-sensitive target dimensions of the PR8 strain of the influenza A virus.

PR8 influenza virus concentrated by a variety of methods was air-dried or lyophilized in different suspending media, and exposed to the irradiation emitted by a low voltage x-ray tube. Following irradiation, the samples were reconstituted and assayed for surviving infectivity or hemagglutinating activity. Inactivation of the hemagglutinin was also studied in the aqueous state.

When the virus was air-dried in 0.5 per cent lactose, the 37 per cent lethal dose for the infectivity was small compared to that required for inactivation of the hemagglutinin. On semilogarithmic plot, the survival curve for the infective fraction was linear, and the radio-sensitive target diameter was found to be 42 mu. An earlier investigator in our laboratories irradiated concentrated influenza virus in aqueous suspension; when these data were recalculated, the target diameter was found to be approximately the same as that for the air-dried virus. This observation was interpreted to mean that the infective fraction represents an internal structure of the virus particle.

In aqueous suspension, the rate of the inactivation of the hemagglutinin was found to be dependent upon the relative "purity" of the virus preparation, but there was no apparent relationship between these two factors in the dried state. This observation was interpreted to mean that the hemagglutinin represents a surface structure of the virus particle.

The x-ray inactivation of the elementary bodies lyophilized in 0.2 per cent gelatin was shown to be statistically independent of three concentrations of virus and two dose rates. Therefore, the observed inactivation of the hemagglutinin was attributed to the direct action of the radiation. It was observed that the method of concentration of the virus and the drying medium altered the 37 per

cent dose and the shape of the x-ray survival curve for the hemagglutinin. Inactivation of virus concentrated by ultracentrifugation resulted in a sigmoid survival curve; this observation seemed to indicate that high speed sedimentation caused aggregation or clumping of the virus particles. The survival curve for virus concentrated by adsorption and elution from red blood cells was nearly linear.

Other investigators have postulated that the influenza virus consists of multiple hemagglutinins and soluble antigen surrounded by a lipid membrane; ether treatment presumably causes the virus to disintegrate. Ether treated virus was irradiated in the dried state, and a straight line survival curve was obtained when the surviving fraction was plotted against roentgen dose on a semilogarithmic graph.

The results of this investigation indicated that several biological factors altered the shape of the x-ray survival curve of the hemagglutinin and the 37 per cent dose. Since the radio-sensitive target size, volume, or cross section are directly dependent upon the 37 per cent dose, the dimensions of the hemagglutinin of the influenza virus previously recorded in the literature cannot be regarded as absolute measurements.

83 pages. \$1.50. Mic 56-3169

### LEUCINE METABOLISM OF STREPTOCOCCUS LACTIS VARIETY MALTIGENES

(Publication No. 18,331)

Helen Patricia MacLeod, Ph.D.  
The University of Connecticut, 1956

The compound responsible for the malt-like aroma and flavor of milk cultures of Streptococcus lactis var. maltigenes has been identified as the branched-chain five carbon aldehyde, 3-methylbutanal. The precursor of this pentanal was found to be the branched-chain six carbon amino acid leucine.

The present study was initiated to ascertain the various biological mechanisms involved in the degradation of leucine to 3-methylbutanal by S. lactis var. maltigenes and to determine at which point in the degradative pathway the action of S. lactis differed from that of the malty variant.

Nutritional studies indicated the essentiality of leucine, valine, and isoleucine for multiplication of both S. lactis and S. lactis var. maltigenes, and the non-essentiality of threonine and pyridoxal for the two microorganisms. The keto acid analog of leucine, alpha-ketoisocaproic acid was shown to satisfy the leucine requirement of both S. lactis and S. lactis var. maltigenes.

Resting cells of the two organisms were shown to possess the ability to synthesize leucine when incubated with alpha-ketoisocaproate in the presence of glutamic acid. The malty variant converted the keto acid as well as leucine to 3-methylbutanal, when resting cells were incubated with either leucine or alpha-ketoisocaproate. Although

both organisms were shown to degrade leucine to alpha-ketoisocaproic acid, *S. lactis* formed little or none of the malty aldehyde from either the keto or amino acid.

Acetone powders of *S. lactis* and *S. lactis* var. *maltigenes* were shown to each contain an active leucine transaminase system. At a pH 8.3 transamination occurred between leucine and alpha-ketoglutaric acid when acetone powders were incubated with these substrates. The occurrence of transamination was shown by the detection of glutamic acid and alpha-ketoisocaproic acid in the mixtures after incubation, however, at a pH 4.6 no evidence of transamination was obtained.

Manometric studies demonstrated an active alpha-ketoisocaproic acid decarboxylase in dialyzed acetone powder of *S. lactis* var. *maltigenes*, which was absent in similar preparation of *S. lactis*.

The formation of the malty aroma compound, 3-methylbutanal by *S. lactis* var. *maltigenes* was shown to involve the removal of the amino group of the alpha carbon of leucine, and the decarboxylation of the resulting keto acid, with simultaneous formation of the malty aldehyde 3-methylbutanal. *S. lactis* possesses the ability to remove the amino group from the alpha carbon of leucine but was shown not to possess an active alpha-ketoisocaproic acid decarboxylating system.

51 pages. \$1.50. Mic 56-3170

#### STUDIES ON THE MECHANISM OF RESISTANCE OF BACTERIA TO LYSOZYME

(Publication No. 18,504)

Peter Henry Matischeck, Ph.D.  
University of Washington, 1956

A lysozyme-resistant mutant strain, LR9, of *Sarcina lutea* was studied in an attempt to determine the mechanism of its resistance to lysozyme.

The resistance of the LR9 strain to the clearing of cell suspensions by lysozyme was not absolute, even at low lysozyme concentrations. Cultivation on lysozyme-containing media enhanced the lysozyme-resistance of this strain. This appeared to be an adaptive phenomenon. Cell and cell wall suspensions of the LR9 strain were cleared slowly but incompletely. The clearing action of lysozyme on both the cells and cell walls was enhanced by combination with trypsin. Under these conditions the cell walls were not destroyed, a resistant "polka dot" membrane being a prominent structure that remained. After mild alkali treatment the LR9 cells and cell walls were completely destroyed by lysozyme. The "polka dot" membrane was apparently destroyed by alkali treatment. Alkali treatment extracted a carbohydrate from the cell wall which appears to be composed of glucose and a small amount of galactose.

The alkali-carbohydrate was shown to be immunologically similar to a mild alkali-extractable carbohydrate from the lysozyme sensitive parent cells. It is not related to the specific LR9 antigen. The specific antigen is probably a heat-stable protein because of its sensitivity to destruction by trypsin and alkali. The specific LR9 antigen was found in all lysozyme-resistant strains of *S. lutea* examined.

Treatment with the alkali-carbohydrate of LR9 cells abolished the capacity of anti-Parent serum to protect parent cells against lysozyme action. The LR9 alkali-carbohydrate also abolished the agglutinating activity of anti-parent serum. Antibody to the specific LR9 antigen had no protective effect on either the LR9 or parent cells. There was no evidence for an antibody to lysozyme substrate in either anti-parent serum or anti-LR9 serum.

The resistance of the cells of the LR9 strain to lysozyme appeared to be due to a complex between the protein of the specific antigen, the alkali-carbohydrate and lysozyme substrate which, possibly by steric hindrance, at least partly blocks the absorption of lysozyme to the substrate and thus prevents its action. The protein of the specific antigen appears to play a major role in lysozyme resistance since, of the three components, this is the only one not present in the walls of sensitive cells.

The cells of the BCG strain of *M. tuberculosis* were shown to contain glucosamine which was slowly released by lysozyme. It was also shown that polymorphonuclear neutrophiles contain granules which stain with orange II in acid solution and which probably contain the lysozyme of the cell.

157 pages. \$2.10. Mic 56-3171

#### A CYTOLOGICAL STUDY OF *COCCIDIODES IMMITIS* BY LIGHT AND ELECTRON MICROSCOPY

(Publication No. 17,138)

Elizabeth Moot O'Hern, Ph.D.  
University of Washington, 1956

The morphology and behavior of certain cellular components of *Coccidioides immitis* were studied by means of stained smears and by electron micrographs of thin sections of this organism.

Nuclei stained with basic dyes after acid hydrolysis or ribonuclease treatment are found in annular, crescentic, and granular configurations. Nuclear divisions are simultaneous only in multinucleate cells. The formation of cross walls is not synchronized with nuclear division, but eventually hyphae become uninucleate in cells far removed from the tip. In hyphae measuring 2.5  $\mu$  or greater in diameter nuclear division is perpendicular to the long axis of the cell. In narrower hyphae the division plane approaches the parallel.

Feulgen stains were obtained only in organisms treated with paradichlorobenzene or calcium chloride prior to fixation.

Nuclei in electron micrographs were shown to be bounded by a double membrane containing pores. A single nucleolus was frequently present in the nucleus.

Mitochondria stained both supravitally and after fixation were found to be most numerous in young, rapidly growing cells. A role in the dissolution of the walls of disjunctive cells and in the formation of cleavage furrows is suggested for the organelles by their orientation near these structures. In electron micrographs the mitochondria were shown to be bounded by a double membrane and to contain cristae frequently open in channels continuous with the cytoplasm.

The cytoplasmic membrane of the cell was shown frequently to be convoluted into the protoplast. The cell wall

was found to be fibrillar and in mature sporangia to be covered with an organized osmophilic layer. Hyphal septa were demonstrated to contain a large quantity of material extractable with lipid solvents. Septal granules were associated with the formation of cross walls; polar granules, staining with periodic acid-Schiff stain, were shown to be composed of glycogen.

Experiments showed that metachromatic material becomes more resistant to the action of hot water, alcohol, and ribonuclease with increasing age of the culture.

The details of cleavage observed support the view that *C. immitis* should be classified among the *Phycomycetes*, but further studies of apparently related organisms will be necessary to determine closer affinities.

160 pages. \$2.10. Mic 56-3172

#### FACTORS AFFECTING THE PRODUCTS OF GLUCOSE FERMENTATION BY LACTIC ACID BACTERIA

(Publication No. 17,336)

Thomas Boyne Platt, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor E. M. Foster

The principal metabolic reaction of the homofermentative lactic acid bacteria is the conversion of hexoses to lactic acid. The degree to which this reaction describes glucose metabolism in these organisms has been found to vary between genera, species, and strains of species. The purpose of this research was to investigate the effects of some commonly varied cultural conditions on the yields of fermentation products by these organisms.

The general plan of the experiments involved comparing the products of glucose fermentation under an arbitrarily chosen set of standard conditions with those found when certain conditions were varied. The standard conditions consisted of strict anaerobiosis, maintenance of the pH at 7.0, incubation at the optimal growth temperature, and the use of a nutritionally complete, complex medium. The cultures used included one or more strains of each of the following species: *Streptococcus agalactiae*, *Streptococcus lactis*, *Streptococcus cremoris*, *Streptococcus thermophilus*, *Streptococcus faecalis*, *Streptococcus durans*, *Streptococcus liquefaciens*, and *Lactobacillus casei*.

In the standard fermentations about 90 per cent of the glucose carbon was converted to lactate, the remaining 10 per cent to by-products. The latter consisted of acetate, carbon dioxide, and 1 or more of the following compounds: formate, ethanol, glycerol, biacetyl, acetoin, and 2,3-butanediol. Succinate, hydrogen, methane, and fatty acids other than acetate and formate were not produced. Smaller amounts of one-carbon than two-carbon compounds were formed. This finding was shown to be the result of fixation of carbon dioxide to acetate.

Elimination of yeast extract from the standard medium prevented growth of *S. thermophilus* and *L. casei*. However, the cultures able to grow without yeast extract converted approximately the same proportion of glucose to lactate as they did in the standard medium. Elimination of the added iron, manganese, and magnesium salts from the

standard medium caused increased yields of one-carbon products, acetate, and ethanol, with less lactate.

At fermentation temperatures 7 C above their optimal for growth, *S. faecalis* and *S. lactis* formed larger amounts of acetate, formate, and carbon dioxide than they did at 10 to 15 C below their optima. With *S. liquefaciens* 3 the opposite result was obtained. The effect of temperature of fermentation was not tested with other organisms.

When the pH was allowed to fall to a growth limiting level during fermentation, more lactate and less by-products (particularly acetate) were formed by 7 of the 9 cultures tested. This effect was related to less dismutation of pyruvate to lactate, acetate, and carbon dioxide and to less fixation of the carbon dioxide at pH values below 7.0.

Aeration reduced yields of lactate and increased the yields of by-products, especially carbon dioxide and four-carbon products. Two general types of aerobic fermentation balances were observed: 1) those with equal amounts of one- and two-carbon products, and 2) those with larger amounts of one-than of two-carbon products. In fermentations of type 1) about 2 millimoles of oxygen were used per millimole of glucose oxidized, while in type 2) more than 2 millimoles of oxygen were used. Glucose oxidation by growing cultures appeared to involve an unidentified oxidative reaction concerned with aldonic acid formation and oxidation of glycolytically-generated DPNH.

Vigorous aeration inhibited the growth of *L. casei* and *S. thermophilus*. This inhibition as well as the duration of the lag phase of cultures which did grow under these conditions were related to the time required to develop peroxidase activity. The streptococci exhibited higher efficiencies of cell synthesis under aerobic than under anaerobic conditions of growth. Therefore it was concluded that the energy generated by aerobic oxidation was usable by the organisms.

277 pages. \$3.60. Mic 56-3173

#### STUDIES ON BOVINE SERUM AND ITS USE IN COMPLEMENT FIXATION REACTIONS

(Publication No. 19,136)

Milton Savan, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Professors Samuel H. McNutt and Carl A. Brandly

The complement fixation test has been employed for the study of immune bodies in the serum of a variety of animal species and in disease conditions caused by bacterial, protozoan, rickettsial and viral agents. With each new attempt at application of the complement fixation test, problems, such as the nonspecific or anticomplementary effects of the antigen or the serum had to be surmounted and modifications in test procedures developed to meet the needs of the specific test system. However, there has been considerable controversy with respect to the usefulness of the complement fixation test in the study of anti-viral immune bodies in bovine serum. It was the purpose of the present study to re-evaluate the procedures employed with bovine serums and with the aid of the newer quantitative techniques, to define, if possible, a suitable complement fixation test for the study of vesicular stomatitis antibodies in bovine serum.

The quantitative complement fixation procedures coupled with the electro-colorometric methods employed in the present studies for the determination of the 50 per cent hemolysis end point provided an accurate evaluation of the degree of fixation obtained.

The investigations indicated that suitable complement-fixing antigens were prepared from pooled chorioallantoic membranes or embryos collected from 9 day embryonated hen's eggs that had been inoculated 36 hours previously with vesicular stomatitis virus. The same antigens when heated at 56C for 30 minutes to render them noninfectious, were equally satisfactory as complement-fixing antigens.

The demonstrated anticomplementary activity of bovine serum was largely eliminated by heating the samples at 56C for 30 minutes before or after they were diluted in proportions of 1:5 with saline.

The studies with the bovine serum-virus antigen system indicated that although a primary fixation period of 30 minutes at 37C was unsatisfactory, when the fixation period was extended to 18 hours at 4 to 6C the fixation of complement was demonstrable. In most instances the fixation was specific and occurred in dilution titers as high as 1:80. Nonspecific reactions did not occur when normal tissue antigens were used in place of the Indiana or the New Jersey virus type antigens. However, some serums did fix complement in the presence of either the Indiana or New Jersey virus type antigens, but the extent of the reaction was invariably greater when the New Jersey antigen was used.

Bovine serums collected in 1955 from an area of the Southeastern United States were examined for the presence of complement-fixing antibodies. Those serums which had neutralizing antibodies at significant levels also contained complement-fixing antibodies, while those samples demonstrated as not having neutralizing antibodies also were lacking in complement-fixing antibodies.

Studies were also carried out with serum samples obtained from a group of cattle three years after they had experienced vesicular stomatitis. The results indicate positive fixation of complement to significant levels in the presence of New Jersey antigen and to a lesser extent in the presence of Indiana antigen. The results conformed to the neutralizing antibody titers of these serums as previously reported.

The investigations demonstrated that the complement fixation procedures may be employed successfully for the study of vesicular stomatitis antibodies in bovine serums. The significance of the cross reactions and the presence of antibodies in the serum of cattle three years after their last known experience with vesicular stomatitis is discussed.

91 pages. \$1.50. Mic 56-3174

#### THE ISOLATION OF COLLAGENASE FROM CLOSTRIDIUM HISTOLYTICUM

(Publication No. 17,488)

Eunice Chambers Schuytema, Ph.D.  
State University of Iowa, 1956

Chairman: Associate Professor R. E. Kallio

Clostridium histolyticum produces extra cellular collagenase. Growth on complex media containing casein

hydrolysate and yeast extract yielded culture filtrates with high collagenase activity. The organism would grow on a chemically defined medium but collagenase was low or absent. The addition of yeast extract and gelatin to the defined medium increased collagenase production without a corresponding increase in growth. Amending the defined medium with collagen or inorganic nitrogen did not increase collagenase production.

A quantitative method, based on the concentration of hydroxy-proline, for determining the potency of the enzyme in terms of digesting purified collagen was developed and employed to follow collagenase activity. The ability of the proteinase to digest casein was used to follow proteinase activity.

Since the culture fluid also contained other proteolytic enzymes a separation procedure was developed using ammonium sulfate fractionation followed by gradient electrophoresis. An apparatus was used which allowed the crude filtrate from C. histolyticum, containing various proteinases and collagenase, to be in contact with a pH gradient. A series of sponges in contact with one another were soaked with veronal buffer in such a way as to have a final pH gradient from 4.0 at one end to 8.7 at the other. Crude collagenase solution was evenly distributed over the entire "gradient" of sponges and the system subjected to a current of 150 volts at 10 milliamperes for 20 minutes. At the end of this time the sponge contents were recovered and assayed for collagenase and proteinase. The collagenase separated from the proteinases with a peak indicating an isoelectric point at pH 8.6.

Examination of a sample from the peak at pH 8.6 by paper electrophoresis resulted in the appearance of only one protein area. Since this material only has collagenase activity, the sample was thought to represent purified collagenase.

The effect of the addition of several metal ions on the collagenase and proteinase activity of the separated samples was tested.  $Mg^{++}$ ,  $Mn^{++}$ ,  $Ca^{++}$ ,  $Co^{++}$ , and  $Zn^{++}$  had no effect on the collagenase or proteinase activity. Ferrous ions and cysteine had no effect on collagenase activity but did stimulate proteinase activity. When the original samples, after gradient electrophoresis, were assayed there were peaks of proteinase activity at pH 5.5 and pH 7.5. The addition of ferrous ions stimulated the activity of the proteinase with the peak at pH 5.5 but did not effect the other proteinase activity. Neutralized cysteine-HCl activated a proteinase not apparent before, with a peak above pH 8.5, not affecting the other proteinase activity.

It was possible to separate four separate proteolytic exoenzymes from the culture filtrate of C. histolyticum. One, a ferrous ion activated proteinase, had its isoelectric point at pH 5.5. Two, a proteinase activated neither by ferrous ions or sulphydryl groups, was isoelectric at pH 7.5. Three, a collagenase, isoelectric point pH 8.5. Four, a proteinase, activated by cysteine, isoelectric point above pH 8.3.

62 pages. \$1.50. Mic 56-3175

**INFLUENCE OF DIETARY ANTIBIOTICS  
AND OTHER CONDITIONS UPON BACTERIA  
IN THE INTESTINES OF CHICKENS**

(Publication No. 19,152)

Ralph Franklin Wiseman, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William B. Sarles

In experiments upon the effects of a bacitracin-penicillin mixture added to folic acid deficient semi-synthetic and "natural" chicken rations, increases in weight gain could be correlated with changes in the microflora of the ileum and ceca.

Though alterations of numbers and kinds of bacteria in the intestines of chicks fed antibiotic-supplemented, semi-synthetic rations were more pronounced, a decrease in lactobacilli and usually an increase in some coliform types was observed when antibiotics were added to "natural" rations. Characterization of the lactobacilli recovered from "antibiotic-fed" chicks revealed that the predominant species in the intestine of chicks maintained on diets without antibiotics is Lactobacillus salivarius n.sp. (Rogosa et al., 1953); an organism which has fastidious nutritive requirements. The removal of L. salivarius by dietary antibiotics benefits the chicken by "sparing" folic acid; hence the deficiency of the ration may be partially alleviated. After approximately four weeks of feeding "natural" antibiotic-supplemented diets, the numbers of intestinal lactobacilli returned to the level found at the start of the experiment. It was observed that this "returned" flora of lactobacilli was resistant to penicillin or bacitracin. The identification of the resistant lactobacilli revealed that a "shift" had occurred and that the reestablished lactobacilli were predominantly heterofermentative Lactobacillus fermenti. These organisms were capable of growth in a synthetic medium lacking added folic acid; hence the original "sparing" of folic acid effect of antibiotics was apparently not operating in the final 8 weeks of study. In experiments

with increased antibiotic supplements it was found that the numbers of resistant lactobacilli were usually below those found in intestinal contents of chicks fed lower levels of bacitracin and penicillin. The lower numbers of lactobacilli may have "spared" some unknown factor, and thus caused the growth response observed.

The increase in numbers of intestinal coliform bacteria caused by dietary antibiotics was shown to result primarily from larger numbers of Aerobacter species. Though increased numbers of E. coli and paracolon bacteria were occasionally observed, the rise in numbers of Aerobacter species was most consistent with the feeding of dietary antibiotics. It was shown that all members of the coliform group are synthesizers of folic acid; hence any increase in numbers of bacteria in this group would benefit the chick by supplementing the folic acid deficient ration. The increased Aerobacter flora was very evident in studies with semi-synthetic diets, but these bacteria were recovered from the tracts of chicks fed the natural-type ration only when the diet was modified with either higher levels of antibiotics or by the substitution of sucrose for 50 per cent of the corn.

The importance of the composition of the diet, the choice and amounts of antibiotics, the intestinal segments analysed, the periods of analysis, and the bacteriological methods employed is emphasized in these experiments.

A new explanation of the action of dietary antibiotics is proposed to account for the growth response of chicks that could not be explained by the "vitamin-sparring effect" or the "enhancement of a vitamin-synthesizing microflora" hypotheses. It is proposed that chicks grow better when the conditions of diet and antibiotic supplement encourage the increase in numbers and activity of bacteria which remove a potentially toxic substance, uric acid, from the intestinal tract. It was found that increased numbers of Aerobacter species found in intestinal contents of chickens maintained on rations containing bacitracin and penicillin were able to utilize uric acid and thus remove it from the intestinal tract.

132 pages. \$1.75. Mic 56-3176

BIOLOGY - GENETICS

**THE EFFICIENCY OF VARIOUS CRITERIA  
INVOLVING THE INDIVIDUAL AND ITS  
COLLATERAL RELATIVES FOR SELECTING  
TURKEYS FOR EGG PRODUCTION**

(Publication No. 17,992)

William Lowry Blow, Ph.D.  
North Carolina State College, 1956

Supervisor: Hamilton Arlo Stewart

The purpose of this study was to determine the relative efficiency of some criteria which may be used to select turkeys for egg production. These criteria were selection indexes constructed from various statistics derived from the North Carolina Experiment Station flock of turkeys.

Information from 2169 individuals from 370 full-sib and 50 half-sib families hatched during the period from 1946 through 1954 were involved in estimating the parameters of this flock. Various estimates of these parameters were obtained from analyses of variance and covariance. Additional estimates were obtained from the covariance between dam and offspring of the various combinations of part and complete records of both dam and progeny. A single estimate of each parameter was obtained by weighting the estimates of the same parameter inversely as their variance.

Predicted breeding value for egg production was expressed as a function of individual performance plus various combinations of the performance of closely related groups of relatives. These relatives included the individual's sibs and half sibs in addition to the dam and

parental sibs and half sibs. Part and full records of the individual and her contemporary relatives and full records of the dam and the parents' contemporary relatives were the basis for selection. Part records were based on the first thirty days' lay, while complete records were recorded in the first hundred days elapsing after the date of first egg.

In terms of expected genetic progress, the indexes which were designed to select among birds that had completed their first season of lay were relatively inefficient. The most efficient index was based on the part records of the individual and its sibs and half sibs plus the complete records of its relatives in the preceding generation. Up to 70 percent greater progress, depending on the family structure of the population, was derived from this index in unselected populations over that attained from selection based on the information contained in the part records of the individual and its full sibs. Adding the half-sib information to the latter index increased the rate of progress by as much as 40 percent. An analysis from some statistics of the University of California's flock of White Leghorns indicated that essentially the same results would be obtained in chickens when the laying period is arbitrarily divided into two periods.

The effects of finiteness of the population in which selection is being practiced was determined for flocks numbering 600 and 1200 individuals. These results indicated that finiteness is not an important deterrent to genetic progress for flocks as large as these. However, there may be a tendency to overestimate the genetic progress in finite populations if flock size is not recognized. Even though genetic progress is somewhat less in finite as compared with infinite populations, the same indexes are used to select in both populations.

Incorrectly estimating the parameters from which the indexes were constructed did not prove to be a serious attenuant of genetic progress. Errors of estimation by as much as 50-100 percent accounted for a decrease in genetic progress of 10 percent or less in most cases. The errors involved in predicting genetic progress were much more serious when the parameters were incorrectly estimated.

111 pages. \$1.50. Mic 56-3177

#### THE HYDROGRAPHY AND PHYTOPLANKTON ECOLOGY OF THE INSHORE, NORTHEASTERN GULF OF MEXICO

(Publication No. 18,668)

Herbert C. Curl, Jr., Ph.D.  
The Florida State University, 1956

The purpose of this investigation was to study, qualitatively and quantitatively, the interrelations between phytoplankton production in the northeastern Gulf of Mexico and the hydrographic and biological environment of the region.

A total of thirty sampling trips were made into the Gulf of Mexico, in 1954, for a distance of twenty-five miles. The base of operations was located at the Marine Laboratory of the Florida State University, at Alligator Harbor, Franklin Co., Florida. Phytoplankton samples were analysed for species composition, cell numbers and total cell volumes. Samples were taken for analysis of salinity,

phosphorus, nitrate, nitrite and oxygen. Water temperature, currents and light penetration were also measured.

The salinity pattern of the inshore waters was found to be controlled by stream flow, particularly that of the Apalachicola River. Minimum salinities were found in early March and were correlated with high stream flow. Maximum salinities were found in mid-August. A re-examination of the salinity data secured by the Department of Oceanography of the Agricultural and Mechanical College of Texas in 1952 (Cruise 3-IC) reveals the influence of the Apalachicola River for a distance of 160 miles to the south in the Gulf of Mexico.

Temperatures in the inshore waters ranged from 14°C to 30°C. A marine climograph constructed for the region indicates an essentially subtropical, marine environment. Hydrographic profiles give evidence of intense local cooling in the spring. This is thought to be due to advection of water that has been cooled elsewhere, rather than the presence of submarine springs. Density inversions were present on several occasions.

Dissolved phosphorus was seldom more concentrated than 0.50 µg-atom/liter and frequently reached zero values. Total phosphorus increased to 1.86 µg-atom/liter in late summer in conjunction with a phytoplankton bloom. No decrease in dissolved phosphorus accompanied the bloom. Ratios of N:P of 100:1 and 40:1 were found in February and March 1955, respectively.

Approximately 100 diatom species, 17 dinoflagellates, 1 coccolithophore and 2 siliciflagellate species were identified. Rhizosolenia alata Brightwell and Hemiaulus spp. were typical of the summer plankton, whereas Chaetoceros spp., particularly C. decipiens, were typical of the winter plankton. Rhizosolenia alata was the most important diatom species in regard to biomass.

Indices of association ( $C_i$  of Cole) were computed for twelve species of diatoms. Twenty-seven associations were significant. The species pairs showing the best associations were: Rhizosolenia alata and R. stolterfotii (+0.589), Skeletonema costatum and Stephanopyxis palmarihana (+0.510), and R. alata and R. setigera (+0.484).

Quantitative analysis of the phytoplankton showed a maximum of  $670 \times 10^3$  cells/liter in October and a maximum of  $38 \times 10^8 \mu^3$ /liter in September.

Production experiments were conducted in April and June of 1955. The average photosynthetic rate in April was  $2.04 \mu$  mols  $\text{CO}_2$  fixed per  $10^{10} \mu^3$  plant material per hour. The average rate in June was  $5.78 \mu$  mols per hour. A net fixation of 6 mols  $\text{CO}_2/\text{m}^2/\text{year}$  was calculated.

295 pages. \$3.80. Mic 56-3178

**STUDIES ON STOCK 172 PARAMECIUM AURELIA,  
VARIETY 4: I. THE CILIARY ANTIGENS OF  
STOCK 172, PARAMECIUM AURELIA.  
II. AN EXCEPTION TO MUTUAL EXCLUSION  
OF THE CILIARY ANTIGENS IN STOCK 172,  
PARAMECIUM AURELIA.  
III. A METHOD FOR OBTAINING AMACRONUCLEATED  
ANIMALS IN PARAMECIUM AURELIA.**

(Publication No. 17,966)

Paul Margolin, Ph.D.  
Indiana University, 1956

**I. The ciliary antigens of stock 172, Paramecium aurelia**

Stock 172, variety 4 of Paramecium aurelia, was found capable of expressing phenotypically 12 different alternative ciliary antigens. Evidence was obtained indicating that strong cross-reactions between an antigenic type and antisera obtained against other types are not due to the activity of the other antigen genes.

A description is presented of the effects upon the pattern of antigenic transformations of various factors such as the differential inhibitions of the initial types, temperature, growth rate and exposure to immobilizing antiserum. Evidence was obtained confirming that an antigenic type is capable of transformation to more than one other type under one set of conditions and that the magnitude of a change in conditions may affect the stability of an existing type in addition to, or instead of, the new conditions themselves. The temperature sequence of the antigenic types of stock 172 was found to be susceptible to alteration and therefore different from those in variety 1, P. aurelia. Additional evidence is presented, indicating that exposure to immobilizing antiserum affects the stability of an antigenic type and the direction of any transformations which may occur, primarily by reducing the rate of metabolism.

Comparison of the temperature relations of the antigenic types of several variety 4 stocks reveals both similarities and differences among corresponding types from different stocks. The effects of environmental factors upon antigenic transformation are interpreted on the basis of a competitive system in which the final outcome is a result of the responses of all the antigenic types in the system, potential and expressed.

**II. An exception to mutual exclusion of the ciliary antigens in stock 172, Paramecium aurelia**

Contrary to the usual condition of mutual exclusion existing among non-allelic ciliary antigens of Paramecium aurelia, stock 172 is regularly capable of expressing simultaneously two ciliary antigens, D and M. This dual expression can be maintained through many reproductive cycles. Under many conditions, antigenic type D is also expressed as a single antigen, but the presence of the M antigen has only been detected as a part of the dual expression DM. Fluctuations in the ratios of the quantities of the two antigens, in a line of descent expressing DM, suggest a competitive relationship; an increase in one antigen is usually correlated with a decrease in the other.

Other antigenic types were found incapable of sustaining dual expression, on the basis either of a similarity in conditions necessary for stability or a readiness of two types to transform to each other preferentially. The capacity for dual expression seems to be associated with some special quality of the 172M antigen. The M antigen

of stock 32 does not show this capacity either in the 172 genome or its own 32 genome. However the 32D antigen is able to come to dual expression with 172M in a stock 172 genome, though not with 32M in a stock 32 genome.

The observations can be explained on the basis either of a non-functioning of the mutual exclusion mechanism or of a state of continuously unstable transformations between D and M.

**III. A method for obtaining amacronucleated animals in Paramecium aurelia.**

Amacronucleated single animals of Paramecium aurelia are produced by a three-step procedure. These steps are: 1. the formation of homopolar double animals, 2. the reduction in number of macronuclei from two to one, and 3. the occurrence of clefts in these unimacronucleated double animals. The amacronucleated single animals are produced from the above described cleft animals either by fission or by complete separation of the two components.

107 pages. \$1.50. Mic 56-3179

**THE GENETIC EFFECTS OF THERMAL NEUTRON AND X-IRRADIATION ON SEEDS OF LYCOPERSICON**

(Publication No. 18,862)

Thomas Robert Mertens, Ph.D.  
Purdue University, 1956

Major Professor: Allan B. Burdick

The major investigation concerned the use of ionizing radiation to produce mutations in the polygenic systems controlling earliness of maturity and plant weight in the tomato. These traits exhibit heterosis in Lycopersicon, when divergent types are crossed. Furthermore, dominant genes seem to be the cause of heterosis for earliness in the tomato (Burdick, 1954). If dominant beneficial growth factors can be radiation-induced, they should be detectable (by the heterosis produced) when an irradiated genome containing them occurs in an individual also having a normal, unmutated genome.

In these studies seeds of autodiploid or inbred lines were irradiated, so that, theoretically, the only difference between a genome from an irradiated plant and one from an unirradiated plant, is radiation-produced. The irradiated and unirradiated genomes were combined by back-crossing an irradiated to a control plant. The earliness traits recorded for progenies so produced included (1) days to first flower on first inflorescence, (2) days to first flower on second inflorescence, and (3) days to first ripe fruit. Fresh weight of plant was used as a measure of plant size.

Two lines were isolated which were especially early. The one was derived from a seed of Burdick's inbred Red Cherry line 018 (L. esculentum), which had received 6,000 r of X-irradiation. This line was about four days earlier and forty ounces heavier than the control line (018). Eight of the 18 plants of this line were heterozygous for an induced lethal. The lethal produced no effect on earliness in the heterozygous condition, but Aa plants were significantly lighter in weight than their AA sibs. No semi-sterility was associated with this line, but 74 percent of

the lines of neutron origin and 37 percent of those of X-ray origin segregated for semi-sterility.

A second line, derived from a seed of Burdick's line 226, an autodiploid *L. pimpinellifolium*, was significantly ( $\alpha = .05$ ) earlier than its control for each of the three earliness traits. The  $R_1$  which was used to produce this line had been X-irradiated with 48,000 r.

These two early lines represent two of the 65  $R_1$  plants from which backcross progenies were extracted. Thus, three percent of the  $R_1$  plants yielded decidedly early lines. This figure may be taken as a tentative estimate of the frequency of mutation in the polygenic system controlling earliness of maturity.

The mean performance of sublines derived from thermal neutron  $R_1$  plants was contrasted with that of sublines from X-rayed  $R_1$ 's. Usually the latter progenies were earlier than the former, and for *L. esculentum* lines the difference was significant. Neutron lines were also lighter in weight on the average, but the difference was not significant.

X-radiation must considerably damage the cytoplasm, such that when the  $R_1$  is used as seed parent, plant weight is considerably lighter than when the same  $R_1$  is used as pollen parent. No such effect was observed for thermal neutron-treated  $R_1$  plants.

Three induced chlorophyll mutations were studied to determine what effect they had on the three earliness traits and weight of plants heterozygous for them. One mutation resulted in heterozygotes being significantly later than homozygous normal plants. The other two mutations had no effect on the mean, but for each of the three, the variance of Aa plants was significantly less than that of AA plants. This was true for the three earliness traits, but plant weight was unaffected.

This phenomenon could be due to the action of a single locus and would then be indicative of a genotype-environment interaction of major proportion. An alternative hypothesis based on the action of induced, linked mutations is suggested.

Tomato seeds were observed to be more resistant (as indicated by germination and survival) to thermal neutrons than are barley seeds, but resistance fluctuates widely, depending on the batch of seeds used. Apparently  $R_1$  resistance is not genetically determined, but dependent on some cryptic physiological condition of the batch of seeds. The protective mechanism is apparently effective in relation to both X-rays and thermal neutrons.

Seeds soaked in LiCl and CdCl<sub>2</sub> solutions and then irradiated with thermal neutrons evidenced significantly more  $R_1$  lethality than did various control series. This was attributed to the Li<sup>8</sup> (n,  $\alpha$ ) H<sup>3</sup> and Cd<sup>113</sup> (n,  $\gamma$ ) Cd<sup>114</sup> reactions.

194 pages. \$2.55. Mic 56-3180

## MULTIVALENT FORMATION AND GENETIC SEGREGATION IN SOME ALLOPOLYPLOID GOSSYPIUM HYBRIDS WITH OBSERVATIONS ON CYTOMIXIS

(Publication No. 18,005)

Patricia Ann Sarvela, Ph.D.  
North Carolina State College, 1956

Supervisor: Dan Ulrich Gerstel

The cytological behavior of some amphiploids in the genus *Gossypium* was analyzed in order to establish the relationship between multivalent formation and genetic segregation. The available amphiploids ranged from types with a high frequency of multivalents to others with very few. Some of the factors that affect multivalent formation such as chiasma frequency and environmental influences were also investigated.

Multivalent formation in two of the hexaploids was intermediate between the maximum of thirteen multivalents which might be possible in an autotetraploid and the absence of any multivalents characteristic of a true allopolyploid. The average number of multivalents in 6n(New World-raimondii) was  $6.16 \pm 0.19$  with non-significant differences between the different lines. Another hexaploid 6n(New World-thurberi) had a lower amount,  $3.61 \pm 0.28$ . The tetraploid between *G. thurberi* and *G. raimondii* had  $3.94 \pm 0.19$  while an essentially autotetraploid hybrid, 4n(G. arboreum-herbaceum), had much higher amount of multivalent formation:  $9.42 \pm 0.69$ . In 4n(Old World-anomalum) hybrids there was a lower amount of multivalents:  $1.90 \pm 0.10$ .

The various numbers of multivalents possible in cotton were used to calculate the expected segregation ratios, assuming that bivalents are the result of homogenetic pairing and multivalents separate at random. This procedure gave a linear relationship between these two values. Observed averages for multivalents and segregation (obtained by Gerstel from the same plants) were then plotted against this line. In most cases the deviations between expected and obtained values could be explained on the basis of random variations. In 4n(G. arboreum-herbaceum) these deviations could be explained by the presence of segregating bivalents. The poor fit of the value for 6n (New World-thurberi) to the expected value was investigated on the basis of the various assumptions made when calculating the line and on other possible sources of deviations; such as, chiasma frequency, tetrads, pollen fertility, ovules, seed set, and mite formation. In general, this procedure can be used to obtain an estimate of the number of plants which have to be grown in order to obtain desired segregates from a given amphiploid.

Two plants were found that showed deviations from the expected behavior. 6n(G. barbadense-raimondii) gave significant differences in multivalents between the dates of collection. One plant of a hexaploid line of New World cotton with *G. raimondii* had a much higher chiasma frequency than in the other hexaploids.

Various abnormalities have been seen such as cytomixis, binucleate cells, somatic loss of chromosomes, and PMC's with reduced and increased numbers of chromosomes. Cytomixis is thought to be responsible for these aberrations.

Cytomixis appears to be a natural process which may occur in either mitosis or meiosis. It takes place through the thin cell walls or along the cytoplasmic bridges between the PMC's. Any external or internal conditions which upset the mechanics of wall formation and the rate of division would also affect cytomixis.

183 pages. \$2.40. Mic 56-3181

**A STUDY OF SOME TYPES OF FLORAL ABORTION AND STERILITY IN SUDAN GRASS (*Sorghum vulgare* var. *sudanense* Hitchc.) AND THE NATURE OF INHERITANCE OF THESE CHARACTERS**

(Publication No. 17,346)

Charley Eugene Townsend, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor D. C. Smith

Sudan grass is a vigorous plant closely related to the cultivated sorghums but tillering more freely. It is used primarily as a pasture crop during the hot dry summer months.

Normally sudan grass is highly self-fertile and usually produces seed abundantly with infrequent sterility of the florets. In some stocks sterility of florets appeared to occur at random and in others it seemed to be non-random in the panicle. It varied also from partial to complete seed failure.

The occurrence of random partial-sterile and barren-sterile plants in sudan grass was first noted at Madison, Wisconsin, in 1947. Non-random partial-sterility was first observed in the Piper variety in 1950 in a seed increase field.

In the fall of 1953 barren-sterile, partial-sterile and fertile plants were propagated from nursery progenies which were segregating for sterility and transplanted in the greenhouse. As much self seed as possible was obtained from such plants.

During the summer of 1954 the  $S_1$  generations were grown in the field. The partial-sterile type was found to include three groups of plants. These were designated as random partial-sterility, non-random partial-sterility and chimera partial-sterility. Crosses involving the different sterility types were made with two normally fertile standard varieties, Tift and Sweet.

Barren-sterility was characterized by the absence of sexual organs. Glume development also was reduced considerably. In some plants the panicle included only a few bare side branches. The breeding behavior of  $S_1$ ,  $S_2$  and  $F_2$  generations indicated that barren-sterility was a monogenic recessive. It was concluded that the very low seed set observed in one progeny and the variation in glume development were due to modifying genes.

All types of partial-sterility were not recognizable in the field until the panicles approached maturity, since the glumes of sterile florets did not develop their characteristic pigmentation. The reproductive structures appeared normal. The  $S_1$  generations of random partial-sterile plants segregated 1 fertile to 1 partial-sterile plant.  $F_1$  plants resulting from crosses involving a partial-sterile and a fertile plant were either fertile or partial-sterile. A partial-sterile, dwarfed plant was noted also.

Pollen abortion studies were conducted. Most partial-sterile plants examined exhibited approximately 50 per cent pollen abortion, although, several plants produced more. The excess pollen abortion was believed to be due to causes other than genetic ones.

A limited cytological study was conducted and normal chromosome pairing relations were observed. However, the breeding behavior suggested the presence of a reciprocal translocation. It was concluded that random partial-sterility was due to cryptic chromosomal changes.

Complete fertility and sterility could not be obtained by selfing non-random partial-sterile plants. Complete or almost complete fertility was restored by crossing to fertile plants. Abnormal pistil development accompanied the partial-sterility. Stamen development was normal. Pollen abortion appeared more variable in the non-random than in the random partial-sterility. It was concluded that non-random partial-sterility was controlled by genes which were modified by some factor or factors not recognizable at this time. In the tests completed the influence of the cytoplasm as a contributing factor was not eliminated.

Chimera partial-sterility was characterized by the production of individual partial-sterile plants which possessed panicles with significantly different amounts of sterility. Such plants occurred in the  $S_1$  generation of a partial-sterile plant and the  $F_2$  generation of a cross involving the same partial-sterile plant as mentioned previously, and a fertile plant. They also occurred in the  $S_1$  generation of a fertile plant. The partial-sterility concerned was believed controlled by genes. Causes for the chimera condition were not determined.

97 pages. \$1.50. Mic 56-3182

**INHERITANCE OF DIFFERENCES IN PACHYTENE CHROMOSOME CONFIGURATIONS IN MAIZE**

(Publication No. 19,160)

Arnold Augustus Wellwood, Ph.D.  
Cornell University, 1956

The present study was undertaken to determine the nature of the inheritance of differences between clumped and well spread pachytene chromosome configurations in maize. Earlier work on this subject and other cases of gene-controlled aberrations of chromosome behavior are reviewed.

From a cytological survey of inbred lines of maize known to possess various types of pachytene configuration, the lines CC5 and L289wx were selected as having consistently well spread pachytene figures. Similarly, line 040B was found to have very much clumped pachytene stages. In determining the mode of inheritance of differences in pachytene configuration, the individual plants used in making the crosses between lines having clumped and well spread pachytenes as well as the individuals of the  $F_1$  and backcross progenies were examined cytologically for the purpose of making the classifications. Reciprocal crosses were made between the inbred lines, CC5 and L289wx, which showed very well spread pachytene configurations, and line 040B, which had very much clumped pachytenes. The character of the pachytene configurations was determined in the  $F_1$  progenies from these crosses and in the backcrosses to the parent lines.

The  $F_1$  progenies from both reciprocal crosses between well spread and clumped pachytene stocks were alike in having a range in type of pachytene configuration that was approximately intermediate between those of the parental inbreds, and did not overlap the parental distributions. The means of the backcross progenies also were essentially intermediate between those of the  $F_1$  and the parental stock used in each case, and their distributions overlapped those of the  $F_1$  and the backcross parent stock regardless of which way the backcross was made. All the backcross distributions were unimodal; they showed no tendency to form distinct and equal classes.

It was concluded that the inheritance of the clumped versus well spread pachytene configuration in the stocks studied is not controlled by a single genetic factor, since the distributions of the backcross progenies were unimodal. Owing to the fact that a two-factor interpretation, with dominance lacking, could account for the observed distributions, no distinction can be made between a two-factor interpretation and any higher number of gene differences. Therefore, the inheritance of the observed differences may be controlled by two or more major genes.

46 pages. \$1.50. Mic 56-3183

#### A COMPARATIVE LIMNOLOGICAL STUDY OF MARROWBONE AND RADNOR LAKES IN CENTRAL TENNESSEE

(Publication No. 17,111)

Cyrus Wymer Wiser, Ph.D.  
Vanderbilt University, 1956

Supervisor: Professor J. J. Friauf.

A comparative study of Marrowbone and Radnor Lakes (artificial reservoirs) was made over a period of one year, from August, 1952 to July, 1953. The former lake is located approximately six miles south of Nashville in the Central Basin, while the latter is situated twelve miles northwest of the city on the dissected edge of the Highland Rim. Both are eutrophic, tropical lakes of the second order with medium hard water.

The physical factors which were studied included the geology of the drainage area, lake morphometry, and variations in color, turbidity, transparency and temperature. Chemical analyses were made for dissolved oxygen, free carbon dioxide, phenolphthalein and methyl orange alkalinites, hydrogen-ion concentration, nitrite and nitrate nitrogen, inorganic phosphates and sulfides. Monthly samples of net plankton and bottom organisms were taken from fifteen different stations on the two lakes. Productivity estimates were based upon the mean annual standing crop in terms of numbers and areal standard units per liter in the case of plankton and numbers and biomass ("formalin weight") per square meter for the benthic fauna.

Both lakes stratified thermally and chemically only in the summer, and the single overturn occurred during the later part of October. Mean color and turbidity were slightly higher in Marrowbone than in Radnor Lake, while the reverse condition was true for average pH. In Marrowbone Lake, turbidity increased when high concentrations of silt were brought in with the runoff; in Radnor Lake, tur-

bidity increased only during phytoplankton pulses. Free carbon dioxide reached high concentrations in the profundal waters in summer and disappeared from the surface waters during a period of six months in Radnor and three months in Marrowbone. The mean total alkalinity and bound carbon dioxide were slightly greater in Radnor than in Marrowbone, and on a few occasions the monocarbonates reached high concentrations in the former. Phosphates were detected only in Radnor Lake, but the average amounts of nitrates found in Marrowbone were four times greater than the average amounts in Radnor.

The mean annual phytoplankton biomass produced in Marrowbone Lake was approximately two and one-half times that produced in Radnor. In both lakes, nearly 80 per cent of the total biomass was contributed by blue-green algae. The major phytoplankters in Marrowbone Lake, in order of importance, were Aphanizomenon, Poly-cystis, Mallomonas, Ceratium, Synedra, and Oscillatoria; those in Radnor were Polycystis, Ceratium and Anabaena. Three phytoplankton pulses were noted in each lake, but only in July did they occur simultaneously in both.

With regard to zooplankton, the biomass produced in Marrowbone was nearly one and one-half times that produced in Radnor. In this latter lake, rotifers constituted the largest portion of the mean annual biomass, with copepods and cladocerans next in importance; in Marrowbone, cladocerans furnished, by far, the greatest biomass. It should be emphasized that, in both lakes, the total biomass of net zooplankton exceeded the net phytoplankton biomass by a ratio of approximately 2 : 1. It is interesting to note also that zooplankton pulses were not always correlated with phytoplankton pulses. Increases in Cladocera at Marrowbone seemed to be more closely related to phytoplankton pulses than any other group in either lake.

Vertical distribution of plankton varied seasonally and appeared to be correlated with oxygen and free carbon dioxide conditions. Considerable variation in horizontal distribution was found, and the different groups of planktoners were distributed independently of one another.

Radnor Lake, contrary to the conditions with regard to plankton, produced a mean annual standing crop of bottom organisms which was over three times that produced in Marrowbone (29,456 individuals with a biomass of 90.8 grams per square meter). Most of this biomass in Radnor was furnished by the larvae of Tendipes and Chaoborus, while in Marrowbone, gastropods, annelids and dipteran larvae were important in the order given. Radnor's higher production of bottom organisms was not correlated with mean depth or with phytoplankton production.

It was concluded that the greater production of phytoplankton in Marrowbone Lake was the result of greater shore line development, the greater percentage of the total water volume in the epilimnion during the summer, a higher nitrate content, less turbidity during phytoplankton pulses, and the addition of commercial fertilizer to the lake. The higher phosphate content of the water in Radnor enables it to produce above-average amounts of plankton. The smaller angle of slope to the basin and the type of bottom materials seemed to be the controlling factors in the greater production of bottom organisms in Radnor Lake.

267 pages. \$3.45. Mic 56-3184

**TRANSMISSION IN RECIPROCAL CROSSES AND  
DOSAGE EFFECTS OF MODULATOR IN MAIZE**

(Publication No. 17,353)

Donald Roy Wood, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor R. A. Brink

Recent work in maize has demonstrated Mendelizing elements that are characterized by transposition from one locus to another in the genome and ability to affect gene expression. Modulator (M<sub>p</sub>) which, when present at the P locus in conjunction with the P<sup>rr</sup> gene conditions variegated pericarp, is such an element.

Two problems were studied in the present investigation: (1) transmission of Modulator through male and female gametophytes and (2) dosage effects of Modulator.

The variegated pericarp phenotype can be described as an unstable white which mutates in somatic tissue to red. The mutations result in red stripes of varying widths on the colorless pericarp of the maize caryopsis. Emerson showed that these mutations can be inherited. Brink and Nilan postulated that the variegated allele was a dual structure comprising Modulator, which suppresses red color, conjoined with the red pericarp, red cob gene, P<sup>rr</sup>. Thus, the variegated allele was equated to P<sup>rr</sup>M<sub>p</sub>, and cells carrying this allele were presumed to be colorless. A mutation from the colorless condition to red was assumed to result from the transposition of Modulator from the P locus to a position elsewhere in the genome. If the chromosome carrying Modulator at its new site was transmitted to the same daughter cell as a variegated pericarp allele, it reduced the rate of mutations of variegated to red. Kernels showing the reduced rate of mutation were called light variegated. Thus, medium variegated was assumed to be P<sup>rr</sup>M<sub>p</sub>/P<sup>wr</sup>, while light variegated was P<sup>rr</sup>M<sub>p</sub>/P<sup>wr</sup> + tr-M<sub>p</sub>-.

Homozygous variegateds are P<sup>rr</sup>M<sub>p</sub>/P<sup>rr</sup>M<sub>p</sub> and, like light variegateds, have two Modulators present. They differ from lights, however, in that both of the Modulators occur at the P locus.

Light variegated lines backcrossed three times to a commercial yellow dent inbred, W8, homozygous for P<sup>wr</sup>, were used in a reciprocal crossing experiment with W8 to

study transmission of Modulator. Seven pairs of families from identical reciprocal matings were produced. The data obtained showed that both transposed Modulator and the variegated pericarp allele are transmitted with equal facility in male or female gametophytes. Modulator in these families proved to be linked with the variegated allele, with 46.3 per cent recombination.

The effect of Modulator upon the mutation of the variegated allele was studied in lines that had been backcrossed five times to the inbred line W23. Homozygous, medium, and light variegated ears were scored in terms of the number of mutations of P<sup>vv</sup> to P<sup>rr</sup> per 1000 kernels. Size of the mutant area was determined by using models of kernels that had been divided into eight parts in such a way that relatively small stripes on the germinal face were equated to relatively large stripes on the abgerminal surface of the kernel. This scheme is in accordance with differential rates of growth in the germinal and abgerminal parts of the pericarp. The number of mutations per 1000 kernels were distributed into appropriate size classes according to the number of sectors which the mutant patch would cover on the models.

The frequency of mutation of P<sup>vv</sup> to P<sup>rr</sup> in medium variegateds was found to be about 1.5 times the number of mutations in homozygous variegateds. It was established that homozygous variegateds mutated about 2.0 times as frequently as the light variegateds.

The following hypothesis was advanced: Modulator present in more than one dose reduces the mutability of the variegated allele regardless of the position of M<sub>p</sub> in the genome. This effect of Modulator is exponential. The second proposition is that, M<sub>p</sub> dosage remaining constant, two variegated alleles give twice as many mutations to red as one allele.

Thus each Modulator conjoined with P<sup>rr</sup> in homozygous variegateds should affect reciprocally the stability of the association of P<sup>rr</sup> and M<sub>p</sub> at the homologous locus. The action of each such M<sub>p</sub> should be the same as that of transposed Modulator upon the single variegated allele in light variegateds. With two alleles present, as in homozygous variegateds, the number of mutations should be twice the number observed in light variegateds.

The results of the comparisons between the three genotypes confirm these postulates.

73 pages. \$1.50. Mic 56-3185

**BOTANY**

**HOST-PARASITE RELATIONSHIPS OF  
THE OAK WILT FUNGUS**

(Publication No. 18,773)

George James Bart, Ph.D.  
The Ohio State University, 1956

In addition to thirty-three species of Quercus, three species of Castanea, one of Castinopsis, and one of Lithocarpus have been previously reported to be susceptible to Endoconidiophora fagacearum. In this study, three- to

five-year-old trees of seventeen species native to Ohio were inoculated with E. fagacearum. Aspen, blue beech, elm, locust, maple, and walnut were found to be immune. Ash, beech, and sourwood were resistant. Dogwood, hickory, hop-hornbeam, sassafras, and wild cherry were slightly susceptible. Oak, chestnut, and apple (Jonathan and Delicious varieties) were susceptible. On the basis of these results, apple, hop-hornbeam, sassafras, and hickory are thought most likely to harbor the oak wilt fungus in nature. Susceptibility of all species of Malus and related genera should be investigated further. Preliminary

attempts to isolate E. fagacearum from wild apple trees and trees in abandoned orchards located near "oak wilt centers" were all unsuccessful.

Wilt symptoms did not develop on inoculated red oak seedlings placed in a nearly saturated atmosphere, although tyloses and gums developed in the xylem. These results support the tylose theory of wilt development. However, leaf discoloration also occurred on young leaves of inoculated plants even in the high-humidity room, suggesting that some other factor besides mechanical plugging of the xylem vessels may contribute to foliar symptom development.

In a comparison of transpiration rates of diseased and healthy oak trees, it was found that inoculated trees lost water more rapidly than check trees during the first sixteen days after inoculation, but, from the seventeenth day on, the check trees lost water more rapidly. Apparently both tylose development and some other mechanism affect rate of transpiration.

In diseased living oak trees Endoconidiophora fagacearum occurs in the xylem of roots, stems, petioles, and leaf blades, but not in the phloem. On cut twig sections, however, the fungus grows more abundantly in the phloem and cambial regions than in the xylem. After the tree dies, the pathogen grows into the phloem.

The fungus is not always uniformly distributed around the circumference of the trunk. Symptoms on inoculated trees almost always occurred first on leaves located on the same side as the site of inoculation. It appears that lateral movement of the pathogen in the early stages of disease is somewhat limited.

47 pages. \$1.50. Mic 56-3186

#### AN INVESTIGATION OF THE DROUGHT HARDENING OF THE SOYBEAN PLANT

(Publication No. 18,572)

Jasper Arnold Clark, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. J. Levitt

The Problem. The ability of the soybean plant to resist severe drought after a period of drought-hardening has been reported. The aim of these experiments was to determine some mechanisms which enable the "hardened" plants to endure drought better than the "nonhardened" plants.

Methods and Procedures. Potted soybean plants were grown in the greenhouse. One group (nondroughted) was watered daily or as often as needed to prevent wilting. The other group (droughted) was permitted to undergo frequent permanent wilting starting about one month after planting the seed or when the stems had five nodes.

The elastic extensibility of cells from the petioles of the two groups was determined by measuring the cells while they were in different molar concentrations of calcium chloride.

A comparison of the rate of water loss and wilting by excised shoots and leaves of the two groups was made. Leaves of both groups were shredded and their rates of water loss measured to determine the cause for the more rapid rate of transpiration by excised leaves from the non-

droughted soybean plants. Since the shredding of the leaves eliminated the more rapid loss of water by the non-droughted leaves, petroleum ether was applied to the leaves of both groups to see if more lipid per unit of leaf surface could be removed from either group. Later, lipids were removed with alcohol from the surfaces of droughted leaves before their rates of transpiration were compared with those of untreated nondroughted leaves.

#### Summary

1. Repeated permanent wilting of sunflower and soybean plants causes the stems to be shorter and the leaves to be smaller. The droughted plants do not wilt as rapidly as nondroughted plants when water has been withheld from both groups for the same length of time.

2. Percentages of water loss to produce wilting in excised shoots of droughted and nondroughted plants of both the sunflower and the soybean differ only slightly and are probably due to differences in mechanical tissue development.

3. If differences in damage by the same percentage of water loss exist, they are slight and are not due to differences in elastic extensibility of the cells since they are in the reverse order to the elastic extensibility which is greater in the nondroughted plants.

4. A pronounced difference in rate of water loss by excised shoots and leaves of droughted and nondroughted soybean plants exists with the droughted leaves losing water less rapidly.

5. Shredding the leaves removes any protection against transpiration that the surface layer gives and results in a more rapid loss of water by the droughted leaves as compared to nondroughted leaves. This indicates that the protoplasm of the droughted plants did not produce any additional water binding colloids that are effective in reducing water loss even when up to 60 per cent of the fresh weight of the leaf had been lost.

6. Leaf surface lipids can be dissolved with petroleum ether. Per unit area more lipid was obtained from the leaves of droughted soybeans than from the leaves of nondroughted soybeans.

7. The removal of lipid with absolute ethyl alcohol from the surface of droughted soybean leaves increases their rate of cuticular transpiration.

8. It is concluded that the additional lipids found in the surface of droughted soybean plants are effective in reducing transpiration. After the stomata close they permit the soybean plant to remain alive during periods of drought.

106 pages. \$1.50. Mic 56-3187

#### VARIATION IN MONOSPORIC ISOLATES OF A STRAIN OF VERTICILLIUM ALBO-ATRUM R. & B.

(Publication No. 18,849)

Wendell Lee Gauger, Ph.D.  
Purdue University, 1956

Major Professor: C. L. Porter

The purpose of this study was to determine the pattern of morphological variation of a strain of Verticillium albo-atrum R. & B. as exhibited by monosporic isolates.

Cytological investigation showed that the conidia of this strain of V. albo-atrum were predominantly uninucleate. It was further found that a single nucleus in each sterigma divided repeatedly to furnish genetic material for all conidia produced by that sterigma.

Single-spore isolations of the parental strain yielded four morphological types of colonies. The morphological types were distinguished on the basis of microsclerotial characteristics, presence or absence of a mucoid growth habit, relative number of conidia produced and the amount of aerial mycelium present. In addition to these, two other morphological types were encountered when single-spore isolations were made from the first encountered types.

The results of single-spore analyses of parental-type cultures showed consistency in only one respect. All single-spore colonies, isolated from the parental strain, could be classified into one of the four morphological categories. The frequencies of the types isolated, however, were unpredictable.

When monosporic colonies were single-spored variant types were often recovered. Each morphological type is characterized both from the standpoint of the variant types which it can produce and the frequency with which the variants arise. All variants were of a type previously encountered.

It was observed that a correlation existed between the change in morphology from one type to another and the potentiality of each type with respect to the variants it was capable of giving rise to. Differences between morphological types involved all morphological characteristics studied.

Although hyphal-tip isolations were made, it could not be stated, with certainty, that the parental strain existed in a heterocaryotic state.

55 pages. \$1.50. Mic 56-3188

tained with 3 N HCl was low, possibly only 10 per cent. The amino acids in the hydrolyzate were isolated by means of two-dimensional ascending paper chromatography. The developing solutions used were phenol-water and collidine-lutidine (1:3)-water. Quantitative estimations of the amino acids were obtained by eluting the spots with 60 per cent methanol containing 2 per cent CaCl<sub>2</sub> and measuring the light absorption (at 440 m $\mu$ ) of the ninhydrin-Ca<sup>++</sup>-amino acid color complex. The results show that on an acetone-extracted, dry-weight basis the average amino acid contents of the mushroom hydrolyzates were: aspartic, 0.369 (range, 0.041 to 1.1); glutamic, 0.091 (range, 0.0025 to 0.55); lysine, 0.137 (range, 0.0 to 1.2); arginine, 0.138 (range, 0.028 to 1.3); histidine, 0.30 (range, 0.0 to 3.4); valine, 0.084 (range, 0.0 to 0.21); methionine, 0.120 (range, 0.0 to 0.95); leucine and isoleucine (sum), 0.130 (range, 0.008 to 0.29); phenylalanine, 0.095 (range, 0 to 0.39); tyrosine, 0.13 (range, trace to 0.60); alanine, 0.118 (range, 0.014 to 0.31); threonine, 0.395 (range 0.03 to 5.0); glucine, 0.29 (range, 0.12 to 3.5); serine, 0.276 (range, 0.006 to 2.9). Proline was present in all hydrolyzates, but only in analysis No. 26 (Polyporus sulfureus), which assayed 7.0 per cent, was the color intensity strong enough to permit reliable measurement. Tryptophan was destroyed by the acid hydrolysis method of preparing the material for analysis. Comparison of the ratios of the so-called essential amino acids (disregarding tryptophan) with the published amino acid requirements of human adults (Rose, 1949) shows that the hydrolyzates are not well balanced as amino acid nutrients. The Marasmius oreades hydrolyzate comes closest to being acceptable with respect to amino acid balance but is low with respect to valine and to the summed leucine and isoleucine content. Amino acid balance could be improved somewhat by supplementing one hydrolyzate with another.

44 pages. \$1.50. Mic 56-3189

#### AMINO ACIDS IN ACID HYDROLYZATES OF SOME BASIDIOMYCETE SPOROCARPS

(Publication No. 18,800)

Stuart Batterson Hughes, Ph.D.  
The Ohio State University, 1956

Thirty wild mushrooms have been collected and identified according to the most recent authorities obtainable: Agaricus campestris, A. sylvaticus, Amanita muscaria, Calvatia craniiformis, Clitopilus abortivus, Clitocybe infundibuliformis, C. monadelpha, Collybia radicata, Coprinus comatus, C. micaceus, Cortinarius autumnalis, Entoloma grayanum, Fistulina hepatica, Hygrophorus bakerensis, Hypoloma lacrimabundum, Naematoloma sublateritium, Lactarius indigo, Lactarius piperatus, Lepiota naucina, Lycoperdon perlatum, L. pyriforme, Marasmius oreades, Panus stipticus, Pluteus cervinus, Pleurotis sapidus, Polyporus sulfureus, Tricholoma columbetta, T. melaleucum, T. russula, and T. terriferum. These mushrooms were preserved in acetone to prevent autolysis until they could be prepared for analysis. Hydrolyzates of the acetone-washed, dried, and ground mushrooms were prepared by autoclaving for 10 hours with 3 N HCl at 15 pounds gauge pressure. Comparison with published amino acid analyses indicates that the extent of hydrolysis at-

#### CYTOTOLOGICAL EFFECTS OF 8 AZAGUANINE IN TERMS OF MITOTIC INHIBITION, ITS PREVENTION, AND ITS RELATION TO DNA SYNTHESIS IN THE ROOT MERISTEM OF VICIA FABA

(Publication No. 19,128)

Edward Alfred Pryzna, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Project Associate and Lecturer  
Robert E. Duncan

As one of a series of studies relating nuclear DNA content to mitotic frequency, the response of the cells of the primary root of Vicia faba to the inhibitory properties of 8 azaguanine were studied. Primary roots were suspended in treatment solutions ranging in concentration from 10 to 160 p.p.m. Counts of dividing cells were obtained from macerated root tips and used as a measure of the mitotic frequency.

8 azaguanine did affect one aspect of the growth process of the primary root in that it completely suppressed mitotic activity within the duration of one mitotic cycle of approximately 25 hours. It did not affect another aspect of the growth process, namely, elongation of cells of the primary root. A prevention of mitotic inhibition, provoked by 8 azaguanine was investigated.

The purines, adenine, guanine, xanthine and hypoxanthine and the ribosides, guanosine, inosine and xanthosine, as well as the desoxyriboside, desoxyguanosine, were individually supplied with the analog in an effort to elucidate the manner in which 8 azaguanine elicited its inhibitory effects. The amount of prevention elicited with adenine and guanine was a function of the concentration used.

Distribution polygons, obtained from microphotometric measurements of the relative amount of Feulgen dye bound in treated nuclei were compared with the distribution of controls in order to establish the effect of the inhibitor.

8 azaguanine at a concentration of 10 p.p.m. completely suppressed mitosis after 24 hours of treatment of meristematic cells. DNA biosynthesis was apparently blocked at both 12 and 24 hours of treatment of meristematic cells at a comparable concentration of the inhibitor.

Adenine was superior to all of the related purines used in relieving mitotic inhibition, induced with 10 p.p.m. 8 azaguanine. Next to adenine, guanine was most effective in relieving mitotic inhibition. Since complete prevention of mitotic inhibition was achieved with adenine, it seemed possible that 8 azaguanine interfered with utilization of free adenine.

An interference in interconversion of guanine to adenine does not seem to be the explanation of the purine-8 azaguanine relationships, since a combined treatment consisting of adenine and guanine did not increase the amount of prevention of mitotic inhibition, even after 48 hours of treatment.

On the basis of the results obtained from this investigation, it has been established that 8 azaguanine elicited its inhibitory properties toward meristematic cells of the primary root of *Vicia faba* at a time prior to the onset of prophase. This effect was manifested by a decrease in the number of cells that were dividing. 8 azaguanine did not exert an inhibitory effect on cells which had already begun dividing because an analysis of mitotic frequencies revealed that there was no shift in the relative duration of actual division stages. 8 azaguanine did not prevent a 4C nucleus which was already in division from proceeding until completion.

8 azaguanine cannot strictly be considered to be an anti-metabolite of only guanine, because adenine was also involved in alleviating 8 azaguanine inhibition-effects. The free bases, adenine and guanine, were more effective than any of the nucleosides used in this investigation, in preventing mitotic inhibition.

61 pages. \$1.50. Mic 56-3190

#### A SEARCH FOR ANTIBIOTICS THAT ACT SYSTEMICALLY IN PLANTS

(Publication No. 19,148)

Peter Hsing-tsuen Tsao, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Assistant Professor Curt Leben  
and Professor George W. Keitt

The urgent need for systemic fungicides for plant disease control is well recognized and antibiotics have great potentialities for this purpose. Lack of adequate screening methods is a limiting factor in the search for suitable antibiotics. This paper reports on a method of using detached leaflets of tomato as a step in screening for such

antibiotics, and on an antifungal antibiotic, B74, which was obtained as a result of a series of screening procedures including the detached leaf method.

Two hundred and fourteen actinomycete isolates inhibitory *in vitro* to 5 plant-pathogenic fungi were obtained by means of a poured plate method from 81 soil samples that had been dried, mixed with  $\text{CaCO}_3$ , and incubated under moist conditions. The soil treatments resulted in reduction of undesired fungal population and permitted the more slowly-growing actinomycetes to become established in the soil dilution plates.

Culture centrifugates of 161 isolates grown in a liquid soybean meal medium in shaken flasks were tested for antibiotic activity against *Glomerella cingulata* in agar-diffusion assays and against *Alternaria solani* in spore germination tests. A leaf strip test was performed on culture centrifugates of 103 isolates. Strips of tomato leaflets were placed in Petri plates on agar containing culture centrifugates and were later spray-inoculated on the upper surfaces with *A. solani*. Selection of isolates for further screening was based on relative phytotoxicity of the culture centrifugates and reduction in number of early blight lesions on the treated tomato leaflet strips.

Culture centrifugates of the 10 more promising isolates were tested for systemic action with the detached leaf test. The base (proximal) halves of detached tomato leaflets were placed in covered aluminum plates on agar containing culture centrifugates, with the tip (distal) halves on plain agar. The leaflets were incubated, and then spray-inoculated on the upper surfaces with *A. solani*. Early blight reduction on the tip halves, parts which were not in contact with the toxicant agar, was used as the criterion for the selection of isolate B74 for further detailed studies.

Because of imperfections, the detached leaf test was modified by suspending the tip halves of the tomato leaflets in the air instead of their being in contact with the plain agar. With the modified method, higher frequency of systemic control of the early blight disease on detached tomato leaflets was achieved. Also, streptomycin was found to be systemic in detached primary leaves of bean by the modified detached leaf test. For both antibiotics under the conditions tested, experimental variations of light and of air circulation did not appear to influence transportation of the antibiotics in detached leaves or leaflets.

Antibiotic B74 was produced by isolate B74, an unidentified *Streptomyces* species, grown in shaken liquid soybean meal medium. The partly purified product was obtained by a procedure involving acid precipitation and solvent fractionation. In agar-streak tests, specific inhibitory concentrations of the antibiotic against 19 plant-pathogenic fungi ranged from 0.002 arbitrary units per ml. to higher than 8 units per ml., the highest concentration tested. Four plant-pathogenic bacteria tested showed high resistance. The antibiotic also had protectant action in tomato early blight greenhouse tests.

Statistically significant early blight disease control was achieved in the greenhouse in numerous tests, but not in all, on leaves of intact tomato plants through systemic action of the antibiotic applied to other parts of the plants. Further work is necessary before conclusions can be reached concerning the degree of systemic action and conditions that affect it.

The detached leaf method, with its many advantages, is regarded as a step towards the development of satisfactory screening methods for obtaining systemic antibiotics for plant disease control.

68 pages. \$1.50. Mic 56-3191

## CHEMISTRY

### CHEMISTRY, GENERAL

#### I. THE APPLICATION OF BENZENEPHOSPHINIC ACID TO THE ANALYSIS OF IRON II. THE REDUCTION OF THE DICHROMATE ION AT MICROMETALLIC ELECTRODES

(Publication No. 17,706)

James Edwin Banks, Ph.D.  
Stanford University, 1956

The development of a new method for the quantitative separation of iron from a number of elements and for the gravimetric determination of iron as ferric benzenephosphinate is reported.

The precipitating reagent, benzenephosphinic acid, is easily purified. It has the structural formula  $\text{C}_6\text{H}_5-\overset{\text{O}}{\underset{\text{H}}{\text{P}}}(\text{OH})$ . Its dissociation constant was determined to be  $.012 \pm .002$  at  $21^\circ\text{C}$ .

Ferric benzenephosphinate is a white compound which is insoluble in water and mineral acids of concentrations as great as 1 N. It contains ferric and benzenephosphinate ions in a ratio of one to three. Its solubility in .100 N. sulfuric acid was measured to be  $(1.99 \pm .03) (10^{-4})$  mols per liter at  $25^\circ\text{C}$ . A formal solubility product constant,  $K'_{sp}$ , was calculated to be  $5.2 \times 10^{-17}$ .

A number of experimental conditions were varied in order to determine their effect on the accuracy obtainable for iron alone. A recommended procedure for the determination of iron in aqueous solutions was deduced.

The recommended procedure was used to determine iron in the presence of other substances. Mercury(II), tin(II & IV), bismuth, titanium(IV), zirconium(IV), molybdenum(VI), tungsten(VI), uranium(VI), and cerium(IV) precipitated under these conditions. Of those substances which did not precipitate, excellent separations were effected from cobalt, manganese, nickel, cadmium, magnesium, calcium, strontium, barium, arsenic(III), phosphate, nitrate, oxalate, citrate, and tartrate. Because of coprecipitation less satisfactory results were obtained with arsenic(V), zinc, chromium, vanadium, and aluminum. The actual amount of coprecipitant was determined in some cases. It appears that the metals coprecipitate as the respective benzenephosphinates.

The recommended procedure allows the determination of as little as twelve and one-half milligrams of iron with an accuracy of 1 per cent. For larger amounts the accuracy is .2 per cent. These values compare favorably with those from other standard gravimetric and volumetric methods for the determination of iron.

The primary advantage of the method developed in this study is that it provides a means for the analysis for iron as well as for the separation of iron from other elements. The precipitate is handled easily and can be dried in a  $110^\circ\text{C}$ . oven. No unusual apparatus or techniques are required.

The polarographic reduction of dichromate at a rotating platinum electrode is discussed. The reduction takes place in acid medium with 1 N. perchloric acid being the most satisfactory supporting electrolyte. Diffusion currents are very nearly proportional to the dichromate concentration. The half-wave potential depends on the nature of the supporting electrolyte. More negative values are observed with hydrochloric acid (0.00 to 0.20 volts vs. the saturated calomel electrode) and sulfuric acid (0.30 volt vs. the S.C.E.) than with perchloric acid (0.40 volt vs. the S.C.E.).

The reduction takes place in two steps in some instances of low acid concentration. The reduction products are probably the chromic ion and metallic chromium. At higher acid concentrations the reduction takes place in one step and the reduction product is probably metallic chromium.

All of the polarographic work was handicapped by poor reproducibility of half-wave potentials and diffusion currents. Many variables were studied in an attempt to overcome this lack of reproducibility. The most important variable is the treatment of the electrode between uses. No wholly satisfactory treatment was found. Cathodic polarization gave the best results of those which were tested. Several other phenomena of electrode behavior are illustrated and discussed.

On the basis of this work it was not possible to recommend a procedure for the determination of chromium by polarographic reduction at micrometallic electrodes.

164 pages. \$2.15. Mic 56-3192

### CHEMISTRY, BIOLOGICAL

#### THE CHEMICAL DETERMINATION OF ESTROGENIC STEROIDS IN SWINE PREGNANCY URINE

(Publication No. 17,912)

Henry Edward Bredeck, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. Dennis T. Mayer

The purpose of this investigation was to determine, by chemical means, the nature and quantity of estrogenic steroids excreted in swine urine throughout pregnancy.

Urine was obtained by early morning collections from four Hampshire sows, and the hormones extracted according to the general procedure of Finkelstein (1952). After isolating estriol by this scheme, estrone and estradiol were separated by means of the column chromatography method of Braunsberg et al. (1954). The individual hormones were estimated quantitatively by colorimetric

means using Kober (1931) reagent, and the correction formula of Allen (1950).

The presence of estrone was confirmed by means of the Zimmermann reaction (1935); estriol was proven to be present by paper chromatographic methods (Axelrod, 1953) and the Bachman reagent (1939).

Analysis of the urine throughout pregnancy showed the presence of two estrogenic steroids; estrone and estriol. Estriol excretion occurred during the third to the fifth week of pregnancy, reaching a peak of 740 mcg per liter of urine during the third week. After the fifth week it disappeared from the urine until the tenth week of pregnancy. It reached its maximum concentration of 1540 mcg per liter of urine during the eleventh week, rapidly dropped to 40 mcg per liter in the fourteenth week, and began to rise again to 740 mcg in the fifteenth week.

Estrone first appeared in the urine collected during the eleventh week of gestation. It reached a concentration in the thirteenth week of 260 mcg per liter of urine, decreased to 60 mcg in the fourteenth week and rose again to its maximum concentration of 440 mcg per liter of urine during the fifteenth week of pregnancy.

When these same sows were re-bred after farrowing, and the urine analyzed during the early part of their second gestation period, no estriol was found during the first four weeks of pregnancy. Estrone excretion did occur, however, during the third and fourth week, having a maximum concentration of 140 mcg per liter of urine in the third week.

The reason or reasons for this changing pattern of estrogen excretion is not definitely known, but several possibilities may be suggested. Factors which may significantly influence this pattern are diet, seasonal variation, age of the animals and number of previous pregnancies. It is believed that the first two probably play a more significant role than the others, but further work is required to definitely establish this theory.

The more important aspect to be remembered is that estrogen excretion does occur, in both instances, around the time of placentation; estrone or estriol may be hormone excreted.

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79 pages. \$1.50. Mic 56-3193

#### THE EFFECT OF PENICILLIN INHIBITION ON AMINO ACID, PEPTIDE AND NUCLEOTIDE METABOLISM OF SARCINA LUTEA

(Publication No. 18,910)

John Wesley Brown, Ph.D.

University of Illinois,

Chicago Professional Colleges, 1956

Supervisor: J. B. Binkley

A wide variety of biochemical alterations have been found to accompany inhibition of bacteria by penicillin. Changes in the bacterial metabolism of amino acids, peptides, nucleotides, and a unique series of molecules containing both nucleotides and peptides as well as hexosamine have been reported. The present investigation is an attempt to determine the earliest consequences of penicillin action by a study of changes in these cellular constituents as a function of time of exposure of the microorganism to the antibiotic.

The growth of a penicillin-sensitive rough variant of Sarcina lutea was inhibited about 50 per cent (measured turbidimetrically) when the cells were exposed to penicillin (1 unit per ml.) for 3-4 hours. Analysis of the cells from aliquots of the cultures taken at various intervals of time revealed that a rapid drop in acid extractable amino nitrogen preceded all other alterations measured. Proline accounted for almost all of this loss within 30 minutes following addition of penicillin. However, after 4 hours exposure to the antibiotic, alterations in other nitrogenous constituents of the cell were noted, and proline made up only about 35 per cent of the difference in acid extractable amino nitrogen between control and treated cells. The results are in accord with Gale's observation that penicillin markedly alters the assimilation of certain amino acids by the bacterial cell.

Such a mechanism of action of the antibiotic appeared to be reasonable in this case, since proline is growth stimulatory for the strain of S. lutea used in these experiments. Yet, inhibition of this microorganism by penicillin does not seem to be dependent upon interference with its mechanism(s) for the assimilation of proline. In a medium containing comparatively low concentrations of proline, the content of this amino acid is reduced by 40-50 per cent. However, no significant effect upon the gross characteristics of penicillin inhibition of S. lutea or upon losses of amino nitrogen from its acid extractable fraction was noted under these conditions, and proline now accounted for no more than 10 per cent of the acid extractable amino nitrogen lost.

The oxygen uptake of *S. lutea* treated with penicillin was equal to or somewhat greater than that of control cells. This confirms the findings of a number of other investigators.

Absorption at 260 m $\mu$  of acid extracts of inhibited cells was above that of controls. Most of this increase could be attributed to an accumulation of purines and/or purine derivatives. This evidence supports the hypothesis of Gros et al. that penicillin inhibits the degradation of certain purine derivatives, in particular, guanosine.

No accumulation of the uridine-pyrophosphate-acetylhexosamine compounds (or their peptide derivatives) reported by Park could be detected in *S. lutea*. Acid extracts of control and penicillin treated cultures of the microorganism were practically identical with respect to their content of pyrophosphate compounds and hexosamine. Furthermore, no accumulation of peptides in the medium or in the acid extractable fraction of *S. lutea* inhibited by penicillin was detected.

Investigations using L-proline-C<sup>14</sup> (uniformly labeled) indicated that penicillin does not alter the rate of incorporation of proline into cellular protein, but that it may inhibit the degradation of protein. An understanding of this phenomenon might provide a more reasonable explanation of the inhibitory action of penicillin on a wide range of bacteria than is afforded by an explanation based upon changes in the bacterial assimilation mechanism.

101 pages. \$1.50. Mic 56-3194

#### STUDIES ON THE METABOLISM OF CARBAMYLASPARTATE IN NORMAL AND NEOPLASTIC TISSUES

(Publication No. 19,075)

Edmundo Calva-Cuadrilla, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Philip P. Cohen

Carbamylaspartic acid is an intermediate in the biological synthesis of pyrimidine nucleotides. A study was undertaken to find out the metabolic significance of this carbamylamino acid in normal, regenerating and neoplastic tissues.

The first part of the dissertation deals with the in vivo synthesis of carbamylamino acid and an attempt to isolate it from the liver following injection of Na<sub>2</sub>C<sup>14</sup>O<sub>3</sub> into rats. Isotopic dilution was carried out with pooled chromogenic and radioactive fractions separated by ion exchange chromatography. The specific activity and the melting point were determined after each of five recrystallizations.

Six experiments are described. The acid soluble supernatant solution from the liver homogenate contained one per cent of the injected radioactivity. The radioactivity was distributed among five peaks. The chromogenic peak corresponding to carbamylaspartic acid was detected between the last two radioactive peaks. The second chromatogram showed the chromogenic peak preceding the radioactive fractions. The isotopic dilution data led to the conclusion that the radioactive peak closely associated with the chromogenic fractions does not contain carbamyl-aspartate.

In the second part of the thesis the preparation of radioactive carbamyl phosphate is described. Urea-C<sup>14</sup> was used to prepare KNC<sup>14</sup>O. The dilithium salt of carbamyl phosphate was recrystallized from a mixture of water and alcohol. The product was analyzed for carbamyl phosphate content by its conversion to citrulline.

The activity of carbamyl phosphate-aspartate transcarbamylase in experimentally produced rat hepatomas was also studied. Rats with primary induced 3'-methyl-4-dimethylaminoazobenzene tumor were used. The enzymatic activity was measured in portions of macroscopically normal liver tissue and portions of well developed malignant nodules from the same animal. A system of L-aspartate, carbamyl phosphate-C<sup>14</sup> and supernatant solution was incubated. Aliquots from the acidified reaction mixture were dried under the radiant lamp and their radioactivity was measured. The analytical method is based on the observation that the carbamyl carbon of carbamyl phosphate but not that of carbamylaspartate or other N-carbamylamino acids, is labile and is expelled as CO<sub>2</sub> when heated with dilute HCl.

The activity of the carbamyl phosphate-aspartate transcarbamylase in the tumor tissue is two to four times higher than the activity in the adjacent liver tissue. A significant variation in the values for neoplastic tissue from different rats was found. This suggested the possibility of different degrees of malignancy or amount of connective tissue. The possible intervention of alkaline phosphatase is discussed.

The last part of the thesis describes studies on the activity of the same transcarbamylase during the processes of regeneration following partial hepatectomy. Sixty per cent of the organ was removed and the operated animals were allowed to survive varying lengths of time. The estimation of the enzymatic activity was done by the procedure described before.

The experimental data show that the activity of the enzyme starts increasing soon after partial hepatectomy. The increase is remarkably rapid in the second half of the first day and shows a maximum around the 50 th. hour. The activity decreases with the same speed in the next 36 hours. The possible mechanisms by which the enzymatic activity increases during the regenerative processes are discussed. The possible relationship of the evolution of this activity with well established morphological, chemical and enzymatic changes during such processes is discussed. So far, the only enzymes which increase their activity during the most active phase of the liver regeneration are the alkaline phosphatase and the carbamyl phosphate-aspartate transcarbamylase.

The dissertation also includes studies on the cellular localization of the activity of this transcarbamylase. The data suggest that it appears to be localized mainly in the final supernatant after complete removal of all particulate components.

Hydroxyaspartate was found to be a suitable substrate for the enzyme, although the rate of transcarbamylation appeared to be lower than that for L-aspartate.

148 pages. \$1.95. Mic 56-3195

**AN INVESTIGATION OF THE MECHANISM OF ACTION OF  $\beta$ -2-THIENYLALANINE IN YEAST**

(Publication No. 18,667)

Charles Russell Crane, Jr.  
The Florida State University, 1956

The optimum conditions for growing large cultures of inhibited yeast, and a method for isolating and analysing the intracellular, free amino acid pool was studied. There was no detectable difference in the free amino acid pools of normal and inhibited yeast cells.

$\beta$ -2-Thienylalanine was synthesized with C<sup>14</sup> in the alpha position, and yeast cultures were grown in the presence of this labeled inhibitor. The harvested cells were ruptured and separated centrifugally into three fractions. These fractions were then analysed for the presence of the radioactive inhibitor. All fractions were found to contain the radioactive isotope, and the methods commonly used to distinguish between true incorporation and physical adsorption indicated that the inhibitor is actually incorporated into the cellular proteins.

A comparison of the activity found in inhibited cultures with the activity found in cultures reversed with phenylalanine or p-tolylalanine was made.

85 pages. \$1.50. Mic 56-3196

**STUDIES OF THE MECHANISM OF ACTIVATION OF PROTEOLYTIC ENZYME PRECURSORS**

(Publication No. 18,494)

William Jakob Dreyer, Ph.D.  
University of Washington, 1956

The proteolytic enzyme precursor, chymotrypsinogen, and various forms of the active enzyme, chymotrypsin, have been investigated in an attempt to elucidate the nature of the molecular changes which occur during the activation process. Some comparative observations on the trypsinogen-trypsin system are also included. A variety of methods has been used including peptide and end-group analysis, paper and moving boundary electrophoresis, column chromatography of peptides and proteins, enzymatic activity determinations, measurements of optical rotation of proteins, and ultracentrifugal analyses.

In the course of the rapid activation of chymotrypsinogen a single peptide is liberated which has been isolated and identified as serylarginine. The appearance of this peptide is exclusively associated with the conversion of  $\pi$ -chymotrypsin to the  $\delta$ -form. These findings, together with those reported by other investigators, have been interpreted to indicate that the splitting of a single peptide bond between arginine and isoleucine in the sequence leucyl-seryl-arginyl-isoleucyl-valine suffices to produce enzymatic activity when chymotrypsinogen is converted to  $\pi$ -chymotrypsin. The subsequent chymotrypsin catalyzed reaction involves the liberation of the dipeptide from the C-terminal portion of  $\pi$ -chymotrypsin.

A comparison of chymotrypsinogen, of rapid and slow activation mixtures, and of crystalline chymotrypsins revealed differences in electrophoretic and ultracentrifugal behavior. The crystalline chymotrypsins exhibit a

relatively high degree of electrophoretic heterogeneity as compared with activation mixtures containing  $\pi$ - or  $\delta$ -chymotrypsin. All of these proteins exist as a monomer at pH 3 within the concentration range of 2-20 mg. per ml. In contrast to chymotrypsinogen, which is monomeric at ionic strength 0.1-0.2 over the entire pH range studied, DIP- $\pi$ - and - $\delta$ -chymotrypsins exist in concentration-dependent monomer-dimer equilibria at pH 7.5. The pH dependence of dimerization of the crystalline enzymes differs markedly from those of the above proteins.

On the basis of a decrease in optical levorotation which occurs upon activation of chymotrypsinogen and trypsinogen, and a greater sensitivity of the optical rotation of both active enzymes, as compared to the zymogens, to changes in pH, it is concluded that limited configurational changes occur concurrently with activation. It is postulated that the newly formed amino-terminal isoleucine chain end exists as an unstable "tail" in both enzymes. This proposed coiled tail structure would be subject to reversible uncoiling in relatively low concentrations of urea and upon variation of pH. In the zymogen, the portion of the molecule affected during activation is presumed to exist in a less highly coiled and more constrained configuration.

A brief comparative study of the antigen-antibody reactions in gel of chymotrypsinogen, several chemically altered chymotrypsinogens,  $\delta$ -chymotrypsin, and DIP- $\alpha$ -chymotrypsin is discussed.

93 pages. \$1.50. Mic 56-3197

**THE DETERMINATION OF PROGESTERONE IN OVARIAN AND ADRENAL TISSUES BY A CHEMICAL AND CHROMATOGRAPHIC PROCEDURE**

(Publication No. 17,918)

Anthony Michael Gawienowski, Ph.D.  
University of Missouri, 1956

Supervisor: Dennis T. Mayer

In this investigation a method was developed for the assay of the progesterone content of biological materials. By combining an extraction method with a modified paper chromatography procedure and the qualitative and quantitative spectrographic analysis of progesterone, a repeatable and satisfactory method was found.

Several procedures of the method include:

- (1) A ligroin-propylene glycol system for the paper chromatography of progesterone.
- (2) A desk germicidal lamp and filter was converted into a simple ultraviolet scanner device for detection of hormones on paper chromatograms.
- (3) An elution chamber was modified for elution of the hormones from the paper chromatograms.
- (4) Qualitative analyses were made from ultraviolet absorption spectra of progesterone and the extract in concentrated sulfuric acid and ethanol.
- (5) Quantitative analyses were made from ultraviolet absorption maxima of progesterone and the extract in ethanol.

All the material used in this study came from sows

killed on the 55th day of gestation. The ovaries of these sows were removed and assayed for their progesterone content. The determinations of progesterone content revealed that 18 of the individual ovaries contained an average of 64.0 mcg. of progesterone with a range of 20 to 125.3 mcg. When the corpora lutea were analyzed separately, they were found to contain from 5.9 to 37.9 mcg. of progesterone with an average of 18.9 mcg. per gram of tissue. The assay of 14 pairs of ovaries revealed an average progesterone content of 132.3 mcg. per pair and a range from 73.3 to 256.0 mcg.

A significant correlation ( $P < 0.05$ ) was found between the amount of progesterone and the weight of the corpora lutea. Also a very high correlation ( $P < 0.01$ ) was found between the progesterone content of the individual ovaries and the number of corpora obtained on the 55th day of gestation in the sow.

Progesterone could not be detected in the adrenal glands removed from four different sows killed on the 55th day of gestation. 131 pages. \$1.75. Mic 56-3198

#### THE MECHANISM OF ACTION OF SERINE HYDROXYMETHYLASE

(Publication No. 18,499)

Youssef Hatefi, Ph.D.  
University of Washington, 1956

1. The conversion of serine to glycine has been studied using a soluble enzyme system prepared from phosphate buffer extracts of acetone-dried beef liver. A partial purification of the crude system has been achieved by means of acetone fractionation, acid treatment, and ammonium sulfate fractionation.
2. It has been found that serine is converted to glycine and a  $C_1$  unit at the oxidation level of formaldehyde. The latter moiety can be oxidized to formate by an enzyme (hydroxymethyl-FH<sub>4</sub> dehydrogenase), which requires TPN as the specific electron carrier. The  $C_1$  unit can be oxidized further to CO<sub>2</sub> by formic dehydrogenase. These two oxidative steps permit the conversion of serine to glycine to be followed both manometrically and spectrophotometrically.
3. The enzyme system is specific for L-serine; D-serine, glycine, sarcosine, threonine and pyruvate are inert.
4. The conversion of L-serine to glycine by the enzyme serine hydroxymethylase requires the presence of tetrahydrofolic acid and pyridoxal phosphate as cofactors. Occasionally, a stimulation by added Mn<sup>++</sup> can also be demonstrated.
5. The oxidation of the  $C_1$  unit released from serine from the oxidation level of formaldehyde to that of formate occurs in association with tetrahydrofolic acid. In the presence of tetrahydrofolic acid and TPN, free formaldehyde, also, can serve as substrate for this reaction.

As a result of these findings, the mechanism of the conversion of L-serine to glycine is discussed, especially with reference to the involvement of tetrahydrofolic acid as the carrier of the  $C_1$  unit released from serine.

101 pages. \$1.50. Mic 56-3199

#### A FATAL SYNDROME IN RABBITS FED PURIFIED DIETS CONTAINING CASEIN

(Publication No. 18,697)

John Francis Herndon, Ph.D.  
Alabama Polytechnic Institute, 1956

Supervisor: Edwin L. Hove

A study was undertaken to discover why rabbits grow exceptionally well when fed soybean meal diets but do very poorly or die when fed purified casein diets. An attempt was made to learn what factor or factors are present in soybean which are low in or absent from casein, and whether or not these factors were related to the herbivorous nature and cecal activity of this animal. The investigation involved a determination of the part played in this problem by factors such as protein level and quality, amino acid availability, type of carbohydrate, accessory growth factors, the relative digestibility of casein and soybean protein for the rabbit, the role played by cecal function.

California white rabbits (male and female) having an average initial weight of about 750 grams were used throughout this study. They were housed in individual cages, having wire bottoms, in an air-conditioned room in which the temperature was maintained at about 78° F the year round. Feed and water were constantly available.

The following results were obtained. Poor growth was noted in rabbits fed a supposedly complete synthetic diet with 18 per cent casein. Growth rates increased when rabbits were fed diets with increased levels of casein. This improved growth was of only a temporary nature; after a few weeks growth stopped and in a few cases loss in body weight was noted. Additions of soybean meal in amounts as low as 15 per cent corrected the inadequacy of casein in all cases. Drackett protein and gelatin with tryptophan and methionine produced some improvement in growth rates of rabbits fed the basal casein diet. Active, water-soluble, growth promoting fractions were obtained from hydrolysates of soybean meal, the most active fractions being obtained from the papain hydrolysates. Arginine, glycine, methionine, tryptophan and histidine improved the growth of some rabbits fed the basal casein diet. A sulfur amino acid deficiency was produced in two groups of rabbits in this study. Certain polysaccharides improved growth of rabbits fed casein diets. Rabbits grew significantly better on an 18 per cent casein hydrolysate (enzymatic) diet than they did on the basal casein diet. Arginine, glycine and methionine, added to the casein hydrolysate diet, improved rates of gain still more. A 9 per cent casein-9 per cent hydrolysate diet, supplemented with arginine, glycine, methionine and tryptophan, allowed near optimum growth. Pepsin and papain, when fed with casein diets, produced some improvement in the growth of rabbits.

In vitro digestion rates by homogenized rabbit pancreas compared favorably with those of rats. Cecal enlargement occurred in rabbits fed the basal casein diets used in this study. The enlargement was not found in rabbits fed casein hydrolysate or soybean meal diets. Nitrogen balance and digestibility studies indicated that rabbits could digest casein efficiently, but studies also indicated that rates of consumption and fecal excretion of rabbits fed casein diets were low. Eighty per cent more nitrogen matter was present in the ceca of rabbits fed 18 per cent casein diets than in the ceca of rabbits fed the soybean diets or

the 9 per cent casein-9 per cent casein-hydrolysate diets.

Probably a factor (or factors) exists in soybean meal that is required by the rabbits fed casein diets for normal growth. That this factor may be present to some extent in casein hydrolysate is also discussed. The probable relation of the fat level in the diet to the rabbits requirement for this factor and the amino acids, arginine, glycine, methionine and tryptophan, is mentioned.

84 pages. \$1.50. Mic 56-3200

#### ENDOCRINE ASPECTS OF THE ANEMIA OF PREGNANCY IN THE RABBIT

(Publication No. 18,854)

Lewis Milton Horger, Ph.D.  
Purdue University, 1956

Major Professor: M. X. Zarrow

The effects of various hormonal regimens on the components of the blood and the thiocyanate space were determined in the gray chinchilla rabbit and compared with the changes observed during pregnancy. Evans Blue dye was used to determine the blood and plasma volumes and the thiocyanate space was used to estimate the volume of the extracellular fluid compartment. In addition, a number of common hematological techniques were used to ascertain the changes in the cellular components of the blood.

During the last trimester of pregnancy there is a 12.3 per cent (P: 0.01) increase in the plasma volume, a 6.3 per cent increase in the blood volume, a 12.6 per cent (P: 0.05) decrease in the erythrocyte count and a 13.2 per cent (P: 0.01) decrease in the relative concentration of hemoglobin. There is no significant change in the total number of erythrocytes, total hemoglobin, total cell volume, or in the thiocyanate space. The anemia of pregnancy in the rabbit is normochromic and normocytic and is attributed to a hemodilution.

The accumulation of water by the conceptus was determined throughout the latter half of pregnancy. The increase in the fluid content of the conceptus was found to be in good agreement with the absolute increase in the thiocyanate space of the rabbit during this period.

In an attempt to reproduce the anemia of pregnancy, ovariectomized rabbits were treated with 0.1, 0.2, 0.4, and 1.0 mg of estradiol per day for 25 days. However, only the treatment with 1.0 mg of estradiol elicited an anemia comparable to that observed during gestation. During the period of treatment with 1.0 mg of estradiol there is a 20 per cent (P: 0.01) decrease in the erythrocyte count and relative concentration of hemoglobin, a 29 per cent (P: 0.01) increase in the plasma volume, a 20 per cent (P: 0.02) increase in the blood volume, and an 8.5 per cent (P: 0.05) increase in the thiocyanate space. There is no significant change in the total cell volume or total number of erythrocytes. The anemia induced by estradiol is normochromic and normocytic and is attributed to a hemodilution. However, due to the observed increase in the thiocyanate space and to the massive dosages required, it is concluded that estradiol is not the sole etiologic agent in the anemia of pregnancy.

Estradiol was also administered to ovariectomized rabbits in combination with progesterone. Treatment with 4 mg of progesterone and 0.1 mg of estradiol causes a greater hypervolemia than the estradiol alone whereas the hypervolemia induced by 4 mg of progesterone and 1.0 mg of estradiol is smaller than that induced by the estradiol alone. Treatment with 2 mg of progesterone and 0.1 mg of estradiol does not modify the action of the estradiol and the response to treatment with 4 mg of progesterone and 0.01 mg of estradiol is the same as the response to progesterone alone. None of the combination treatments cause significant changes in the thiocyanate space or the hematocrit. Thus under the conditions of this experiment, a ratio of progesterone to estradiol of 4:1 inhibits the action of estradiol, a ratio of 40:1 augments it and a ratio of 20:1 has no significant effect on the estrogenic activity. Although the combination of estrogen and progesterone exerts a strong influence on the fluid metabolism of the female, it is not solely responsible for the anemia of pregnancy.

On the basis of this study and the information available in the literature, it is concluded that the hypervolemia of pregnancy is caused by a number of structural changes in the cardiovascular system during the latter part of gestation. The factors contributing to the hypervolemia of pregnancy are the increased size and vascularity of the uterus, the arteriovenous leak through the placenta and the tendency towards dilatation of the peripheral blood vessels. Thus the hypervolemia appears to be only indirectly related to the alterations in the endocrine balance during pregnancy. Consequently, while the sex steroids are important factors in producing the changes which cause the hypervolemia, they alone cannot account for the anemia of pregnancy in the rabbit. 144 pages. \$1.90. Mic 56-3201

#### STUDIES ON 4-HYDROXYCOUMARINS: I. THE ATTEMPTED RESOLUTION OF WARFARIN. II. THE CHEMISTRY OF 3-ACYL-4-HYDROXYCOUMARINS.

(Publication No. 17,319)

Robert Albert Kloss, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Karl Paul Link

#### Part I

A study of various approaches to the resolution of warfarin is reported. The attempts to prepare intermediates which after resolution could be converted to warfarin were not successful. The condensation of ethyl benzalacetacetate with 4-hydroxycoumarin gave warfarin or 2,5-dioxo-3-acetyl-4-phenyldihydropyrano-(3,2-c)(1)-benzopyran, depending upon the reaction conditions.

The d-camphor-10-sulfonate of d-warfarin was prepared. Attempts to separate the diastereoisomers by fractional crystallization were not very successful. However, a small quantity of pure d-camphor-10-sulfonate of d-warfarin was isolated and was identical to the compound prepared from a sample of d-warfarin (obtained by an independent worker). Thus, confirmation of the resolution

of warfarin was achieved. When solutions of the d-camphor-10-sulfonate of d- and of l-warfarin were mixed, a compound precipitated that was identical to that obtained when the d-camphor-10-sulfonate of dl-warfarin was prepared. It was concluded that the product formed from dl-warfarin exists largely as a "diastereoisomer."

#### Part II

A preliminary investigation of the chemistry of the 3-acyl-4-hydroxycoumarins is reported. The nature of the 3-acyl-4-hydroxycoumarins is discussed in view of infrared spectrophotometric studies with the conclusion that they exist as resonance structures involving the acyl group and the enolic hydroxyl group. The reaction of 3-acyl-4-hydroxycoumarins with ammonium salts leads to 3-acyl-4-aminocoumarins, or 3-( $\alpha$ -aminoalkylidene)-2,4-diketochromans, or their possible tautomers. The action of ammonium acetate on 3-benzoyl-4-hydroxycoumarin and on a benzyl ether of 3-benzoyl-4-hydroxycoumarin led to products whose melting points and infrared spectra indicated that they were not polymorphs. It was concluded that one of these compounds is 3-benzoyl-4-aminocoumarin and the other 3-( $\alpha$ -aminobenzylidene)-2,4-diketochroman, but the parentage of these isomers cannot be indicated. The analogous products are obtained from primary amines. Secondary amines gave amine salts of the acyl-hydroxycoumarins.

The reaction of hydroxylamine with these acyl-hydroxycoumarins gave the expected isoxazole, while the reaction with hydrazine provided only the hydrazone.

68 pages. \$1.50. Mic 56-3202

#### THE EFFECT OF VITAMIN B<sub>12</sub> DEFICIENCY ON CHOLINE METABOLISM. (PARTS I AND II)

(Publication No. 18,304)

Don Eldon McOskey, Ph.D.  
Cornell University, 1956

The elucidation of the biochemical function of vitamin B<sub>12</sub> has been an intriguing and somewhat unrewarding problem. It definitely has been implicated in one-carbon metabolism and thus with choline metabolism. Vitamin B<sub>12</sub> has been known to have a sparing action on choline, but its exact biochemical action, in this regard, is not clearly defined. Choline is metabolized by three known pathways: (1) the oxidation of choline to betaine, the latter compound representing the actual methyl donor for transmethylation reactions, (2) the formation and hydrolysis of acetylcholine, and (3) the incorporation of choline into the various phospholipid fractions. Only the latter two pathways were studied since it has been shown that vitamin B<sub>12</sub> has no effect on the oxidation of choline to betaine.

Cholinesterase activity was determined on the brain tissue of chicks during embryonic development and up to five weeks of age. Phospholipids were measured in the total embryo, the embryonic brain, and in the brains of chicks up to five weeks of age.

To study the effect of vitamin B<sub>12</sub> deficiency on brain cholinesterase and phospholipids in older birds, chicks

from hens receiving a deficient diet were used. The chicks were divided into two groups. One group was maintained on a deficient diet while the second received the same diet supplemented with adequate vitamin B<sub>12</sub>. Chicks from both groups were taken at 1, 2, 3, 4, and 5 weeks of age. For the cholinesterase determination, the brains were homogenized, and the activity measured using the manometric method. For the phospholipids, the brains were lyophilized, extracted, and the amount of lecithin, cephalin, and sphingomyelin was determined.

The embryonic tissues were obtained from eggs of vitamin B<sub>12</sub> deficient hens. The tissues used as controls were obtained from eggs of hens fed an adequate diet. Live embryos were taken at 12, 15, 18, and 21 days of age. Three composite samples, each containing embryos from eggs of five different hens, were taken at each period. In the preparation of the tissue for analysis, the embryo was removed from the egg and separated from the yolk sac. The brain was dissected out, weighed, homogenized in water, and an aliquot removed for the determination of cholinesterase activity. The remainder was frozen and dried for the determination of phospholipids. The embryonic tissue minus the brain was lyophilized and phospholipids run on the individual composite samples. The cholinesterase activity was measured by a new colorimetric method developed by the author.

The results showed that vitamin B<sub>12</sub> deficiency had no effect on the cholinesterase activity of brain tissue either during embryonic development or for chicks up to five weeks of age. With respect to the phospholipids, it was noted that the sphingomyelin fraction of the deficient embryos was about 50 per cent lower than the normal embryos at 18 days of embryonic life and remained low through five weeks of age although the difference decreased to about 20 per cent. The lecithin and cephalin fractions were not affected to the same extent as was sphingomyelin. There seemed to be a trend toward lower levels of these two fractions but it is doubtful that the observed differences are significant.

The phospholipids of the embryonic brain tissue are affected only slightly by vitamin B<sub>12</sub> deficiency. The amount of sphingomyelin per brain was almost identical in both the deficient and the control tissue through 18 days. However, at 21 days of incubation, the amount of sphingomyelin in the control tissue was about 50 per cent above that found in the vitamin B<sub>12</sub> deficient tissue. It was also observed that the amount of sphingomyelin per brain at hatching was from five to seven times lower than one week after hatching. The lecithin and cephalin fractions were probably not affected significantly although there was a trend toward lower amounts of both lecithin and cephalin.

94 pages. \$1.50. Mic 56-3203

**THE INFLUENCE OF BLOOD ON GLUTAMIC ACID METABOLISM AND THE NON-ENZYMIC CONVERSION OF DOPA TO MELANIN WITH SPECIAL REFERENCE TO LEUKEMIA**

(Publication No. 19,122)

Carl Monder, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Professors Robert M. Bock,  
Harry A. Waisman, and J. N. Williams, Jr.

Dopa (3,4-dihydroxyphenylalanine) auto-oxidation was not retarded by several copper-chelating agents, or in copper free solution. The inhibition of dopa auto-oxidation by diethyldithiocarbamate (DDC) resulted from the preferential oxidation of DDC. Copper-DDC complexes did not alter the rate of dopa auto-oxidation. It was concluded that cupric ions are not essential for dopa auto-oxidation. The auto-catalyzed oxidation of dopa terminated with the overall consumption of 8 microatoms of oxygen per micromole dopa. During the period of most rapid oxidation, the rate of oxygen uptake was 14 times that of dopa disappearance. Auto-oxidation was inhibited by benzenesulfinate. Oxidation of dopa measured spectrophotometrically as dopa disappearance and manometrically as oxygen uptake followed first order reaction kinetics with respect to time and initial dopa concentration after the lag period. Small amounts of dopachrome were formed during the oxidation of dopa at 37°, while larger amounts accumulated at 100°. Added dopachrome decreased the lag period of dopa oxidation, while added 5,6-dihydroxyindole was much less effective. The oxidation of dopa was catalyzed by hydroxyl ions. An hypothesis accounting for the observed effects of hydroxyl ion is presented. The inhibition of dopa auto-oxidation by human blood plasma and plasma proteins was demonstrated. The evidence indicated that this inhibition was caused by removal by plasma proteins of dopachrome formed during dopa oxidation. The oxidation rate of dopa was increased by cupric-plasma protein complexes and, to a lesser extent, cupric ions. With 10<sup>-4</sup> M Cu<sup>++</sup>, globulin was more effective than albumin. Dialysis, partial acid hydrolysis, deamination, or blocking of SH groups of plasma did not affect copper-plasma catalysis. Catalysis was decreased by partial alkali hydrolysis. Glycine and pyrophosphate inhibited, and Tris(hydroxymethyl)aminomethane accelerated copper-plasma catalyzed oxidation relative to oxidation in phosphate buffer. In the presence or absence of plasma, copper ions increased dopa oxidation up to a maximum, beyond which more copper had no effect. Oxidation was directly proportional to plasma level up to 1.2% protein. Dopa added to copper-plasma beyond 0.76 mg dopa was oxidized more slowly than during auto-oxidation. The rates of copper- and copper-plasma catalyzed oxidation were dependent on the hydroxyl ion concentration, and became the same as auto-oxidation at pH 7.8 and 8.5, respectively. The effects of temperature on auto-, copper-catalyzed, and copper-plasma catalyzed oxidations were in accord with the Arrhenius equation between 22° and 48°. The heats of activation for copper- and copper-plasma catalysis were similar to each other, but less than for auto-oxidation. Normal human blood plasma inhibited copper-catalyzed oxidation of dopa more effectively than did plasma from leukemia or cancer patients. The relative effectiveness of the plasmas was correlated with the

total plasma protein, but not with the globulin, albumin, or albumin:globulin ratio.

Glutamic acid dehydrogenase was estimated spectrophotometrically in white blood cells from patients with acute, chronic granulocytic, and chronic lymphatic leukemias, and cancer. The average values for each of these groups were similar to one another and several times higher than white blood cells from patients without leukemia or cancer or from "normal" blood donors. Red blood cells and plasma contained no detectable glutamic acid dehydrogenase activity. Glutamic-oxalacetic acid transaminase is present in human white blood cells and plasma as determined by manometric assay. No activity was found in red blood cells. No significant differences were observed in plasma transaminase activity from patients in the classifications studied. White blood cell glutamic-oxalacetic acid transaminase levels were similar in the patients with various forms of leukemia, other diseases, and normal controls. 172 pages. \$2.25. Mic 56-3204

**RELATIONSHIPS OF MAINTENANCE OF LIVER ENZYME ACTIVITY TO DIET; AND STUDIES ON TECHNIQUES AND USE OF PORTAL VEIN CANNULATION IN DOGS (PARTS I AND II)**

(Publication No. 17,337)

John Raulston Prigmore, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor J. N. Williams, Jr.

This investigation has been concerned with an evaluation of the influence of dietary protein and amino acid interrelationships and imbalances (and thus nutritional stresses) in animals. Included are studies on the relationships of maintenance of rat liver enzyme activity to diet and studies on techniques and use of portal vein cannulation in dogs.

Restriction of food intake to 40 per cent of the ration consumed by ad libitum-fed control rats led to no demonstrable changes in the liver enzyme activity of xanthine oxidase, succinic oxidase, tyrosine oxidase, and endogenous oxidation. In marked contrast, activities of all the above enzyme systems were significantly reduced by a non-protein regimen, except endogenous oxidation which remained constant. The non-protein ration prompted the only decrease in liver nitrogen levels observed in this study. Acute inanition (complete withholding of food for 7 days) caused a general, but not drastic, loss in enzyme activity. The decrease was much less than that apparent in non-protein-fed animals.

The rat liver enzyme activity responses to a non-protein diet followed by single amino acid-deficient diets have been compared to responses observed in earlier studies under conditions of initial single amino acid-deficient diets. The liver enzyme activities of xanthine oxidase, succinic oxidase, and choline oxidase were studied; dietary regimens included histidine-free, methionine-free, and lysine-free diets. The activities of the liver enzymes studied and the liver nitrogen concentration increased when the amino acid-deficient rations were fed to protein-depleted animals. Thus, some

"utilization" of the incomplete proteins must have taken place.

To obtain a suitable sampling procedure for *in vivo* digestion and absorption studies, investigations have been made to develop a reliable technique for cannulating the hepatic-portal vein of dogs. Evidence is presented indicating that the primary cause of cannula failure with earlier portal vein cannulation techniques was possibly the result of a thrombus developing from inflammation of the venous walls. It has been concluded that, in subsequent experiments, innovations such as the placing of a silver clamp around the tubing, maintenance of heparin (in direct contact with the vein) in the tubing, daily removal of blood samples, and particularly routine exercising of the animals after cannulation, will give cannulas that are functional for considerably longer periods than possible earlier.

A study has been made of the effect of excess threonine supplementation on the rate of delivery of amino acids to the portal vein blood of dogs fed a standardized casein test meal. It was found that 1.8 per cent DL-threonine, when added to a 9 per cent casein-sucrose meal, caused a delay in the rate of delivery of L-tryptophan, L-leucine, and L-phenylalanine to portal vein blood. In contrast, the addition of 1.8 per cent DL-threonine to 18 per cent casein-sucrose meals led initially to higher, then to approximately the same plasma levels when compared with threonine-unsupplemented controls.

88 pages. \$1.50. Mic 56-3205

#### EFFECTS OF GIVING LOW LEVELS OF FLUORIDE TO ALBINO RATS FROM CONCEPTION UNTIL OLD AGE

(Publication No. 18,359)

William Floyd Ramseyer, Jr., Ph.D.  
Cornell University, 1956

Experiments were designed to evaluate the effects that low levels of sodium fluoride would have on the albino rat when the fluoride was consumed from conception until old age. Sodium fluoride at levels of 1, 5 and 10 ppm fluorine was administered *ad libitum* in the drinking water. The animals in Experiment I were sacrificed at 150 and 520 days of age and those in Experiment II were sacrificed at 150 days of age.

The teeth of the 150 day old animals in Experiments I and II were almost devoid of dental lesions. Only three of 360 animals examined exhibited dental decay and no periodontoclasia was evident in these animals. The teeth of the 86 animals which were sacrificed at 520 days of age exhibited a higher incidence of dental decay than did the 150 day old animals. The incidence of dental decay was greater in the fluorine fed rats. It was observed that any 520 day old animal that had two or more carious teeth also had periodontal lesions. Dental caries and periodontoclasia in animals suffering from chronic fluorosis may be closely correlated.

Fluorine is deposited progressively in the femur of the albino rat as age and level of fluorine are increased. There appear to be substantial individual differences in the rate of deposition of fluorine. At the 5 and 10 ppm

fluorine level, the females tend to store more fluorine in the bones than do the males. However, at the 0 and 1 ppm level this storage difference is less evident.

In the 520 day old animals, kidney lesions were manifest in the animals receiving fluorine in the drinking water. The progressive increase in fluorine consumption was followed by an increase in the amount of renal tubule hypertrophy. All of the 520 day old animals exhibited some degree of interstitial nephritis while those animals receiving the most fluorine usually showed the most severe nephritis. When the kidneys were examined macroscopically, no abnormalities were evident.

In relation to physical effects, no significant differences were found relative to body weight, weight of dry femur, weight of the dry fat-free femur, or density of the femur, other than sex differences. The males in both age groups exhibited a greater increase in body weight, dry femur weight, and dry fat-free femur weight. However, the density of the femurs was greater in the females than in the males. The body weight of the 150 day old group was less than that of the 520 day old group. The weights of the dry and the dry fat-free femurs of the 150 day old group were less than those in the older group. The femurs of the older age group contained a larger quantity of lipid material than did the femurs of the younger group.

The data indicate that the density of the femurs of younger animals is greater than the density of the femurs of older animals.

The one criterion which does not seem to be influenced by age, sex or low levels of fluorine is the percentage composition of mineral matter in the dry fat-free femur. The femurs contain about 60 per cent mineral matter.

220 pages. \$2.85. Mic 56-3206

#### STUDY OF THE PEROXIDASE SYSTEM OF LEUCOCYTES AND ITS ROLE IN THE FORMATION OF ALLOXAN FROM URIC ACID

(Publication No. 19,141)

Guillermo Soberon, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Philip P. Cohen

Hyperglycemia and alterations in the  $\beta$  cells of the pancreas have been produced in rabbits by the intraperitoneal injection of uric acid. To produce this effect it was necessary that the animals be subjected to a diet deficient in methionine and cysteine. It is not known if the injury of the  $\beta$  cells of the pancreas is due to the whole uric acid molecule or to a metabolite originating from it.

Intraperitoneal injections of uric acid were given to rabbits. Glucose, glutathione and uric acid in blood were determined. Allantoin and uric acid in urine were also measured. A drop in blood glutathione, an increase in blood uric acid and an increase in the urinary excretion of uric acid and allantoin were found. Hyperglycemia was present in fewer than a half of the animals treated (24).

Alloxan has been proposed as the metabolite originating from uric acid responsible for the injury of the  $\beta$  cells of the pancreas. Several attempts to find the enzymatic system that would produce this conversion have been unsuccessful. The breakdown of uric acid has been

demonstrated in humans who lack uricase. The enzymes responsible for this process have not been clearly elucidated. Catalase and myeloperoxidase were able to oxidize uric acid *in vitro*.

The oxidation of uric acid by leucocytes (which are very rich in myeloperoxidase) in the presence of hydrogen peroxide was investigated. It was found that hydrogen peroxide and reaction products inhibit the enzyme. By means of fluorimetric determination and by the use of uric acid labeled with C<sup>14</sup> in position 2 it has been demonstrated that alloxan is one of the products of the reaction. Even though the major part of alloxan was produced by acidification of an intermediate, a small amount could be detected at pH 6.0.

Correlation between the guaiacol technique for assay of peroxidase and the benzidine staining indicates that the latter is the result of an enzymatic process.

The kinetics of the guaiacol reaction show that more reliable assays are obtained when working under K<sub>1</sub> conditions. Specifically, under K<sub>4</sub> conditions, in contrast to K<sub>1</sub> conditions, there is initial lag period.

213 pages. \$2.80. Mic 56-3207

#### STUDIES IN THE METABOLISM OF SULFUR BY PENICILLIUM CHRYSOGENUM

(Publication No. 19,145)

Philip Leslie Tardrew, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Marvin J. Johnson

Much information has been accumulated in relation to the production of high penicillin yielding mutants of *P. chrysogenum*. Also, the environmental conditions which are optimum for the production of penicillin by the mold have been defined. Cystine and valine have been shown to be metabolic precursors of penicillin. However, very little is known about changes in sulfur metabolism related to the increases in the production of penicillin by the mold. Analysis of fermentation broths iodometrically and by bioassay revealed differences in the behavior of fermentations to which phenylacetic acid was added as precursor and those to which no precursor was added. This led to the postulation of the formation of a "penicillin nucleus" when no precursor was added to the fermentation.

In the light of these results, the distribution and nature of sulfur compounds which are formed by *P. chrysogenum* under conditions conducive to penicillin production were investigated. Radioactive sulfur was used as a tracer in these investigations. Two strains were compared, namely the high penicillin producer, 51-20F3, and the related low producer, 49-408. The high yielding strain, 51-20F3, utilized inorganic sulfate at a higher rate than the related low producing strain, 49-408. Organic sulfur compounds were excreted in larger quantities by strain 51-20F3 than by strain 49-408. Chromatographic analysis of fermentation broths showed that a large number of sulfur compounds are excreted in small quantities by both strains. A sulfur-containing compound which was not a penicillin was detected in the fermentation broths of strain 51-20F3 when no phenylacetic acid was added to the medium as

precursor. This compound (VI) was not excreted by strain 49-408 under any conditions and did not appear in broths from fermentations to which phenylacetic acid was added as precursor with strain 51-20F3. The excretion of compound VI was shown to closely parallel the excretion of penicillins. Its excretion could be stopped by the addition of phenylacetic acid. The cessation of the excretion of compound VI was associated with an increase in the rate of penicillin production.

Compound VI has been partially purified by solvent extraction and chromatography. It has been shown to be an acid with a pK of approximately 2.5 to 2.8. Both the thiazolidine and  $\beta$ -lactam structures of penicillin were apparently absent in compound VI. Compound VI is unstable to the action of strong acid. No free sulphydryl or disulfide groups could be detected. Compound VI showed either a negative or weakly ninhydrin reaction.

103 pages. \$1.50. Mic 56-3208

#### THE SYNTHESIS AND PROPERTIES OF LARGE MOLECULAR WEIGHT, WATER-SOLUBLE POLYPEPTIDES

(Publication No. 17,349)

Karl Frederick Weinke, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor Mark A. Stahmann

Linear copolypeptides containing up to four different amino acid residues were prepared by the polymerization of N-carboxyamino acid anhydrides in anhydrous dioxane. The type and molar ratios of the constituent amino acid residues were varied. Considerable control over the size of the linear copolymers was obtained by controlling the ratio of anhydride to initiator. The potential hydrophilic gamma carboxyl and epsilon amino groups of these linear copolypeptides were freed to yield amphoteric polypeptides of relatively high molecular weight which were soluble in dilute aqueous acid or alkali.

Branched copolypeptides were prepared by the polymerization of N-carboxyamino acid anhydrides in bicarbonate buffered aqueous solutions of linear polypeptides containing L-lysine residues.

Some examples of these branched copolypeptides include: Multi (poly-L-leucyl) poly L-lysine, Multi (poly-L-leucyl) copoly-glycyl, L-leucyl, L-glutamyl, L-lysine, and Multi (copoly-glycyl, L-leucyl, L-glutamyl) copoly-glycyl, L-leucyl, L-glutamyl, L-lysine. From endgroup analyses of the linear backbone polymer and quantitative amino acid analyses of the backbone polymer and of the branched copolypeptides, it was calculated that the average molecular weights of some of the larger branched copolypeptides ranged from 18 to 90 thousand.

Branched copolypeptides containing glutamic acid residues were slightly more soluble in dilute salt solution than in distilled water and were precipitated from aqueous solution by concentrated sodium and ammonium sulfate, by trichloroacetic acid and by perfluorooctanoic acid. Some of their properties resembled those of the soluble proteins. They were soluble in water, as the alkali salt of their gamma carboxyl groups, up to a level of 10% (w./v.).

Titration analyses of the branched copolymers gave pK values of the gamma carboxyl group of 4.5 and of the terminal amino group of approximately 8.4. Linear amphoteric polypeptides displayed pK values of the gamma carboxyl group of 4.4 and of the epsilon amino group of approximately 11.0.

Electrophoretic examination showed that a representative linear copolyptide exhibited one maximum at pH 8.5 and at pH 10.2. A representative branched copolyptide showed one maximum at pH 10.2, but at pH 6.3 two maxima were found. This experimental evidence showed that the branched polypeptide molecules were not completely homogeneous and/or exhibited some sort of association phenomenon at the lower pH values.

Preliminary biological studies showed the branched copolyptides to possess a low toxicity and to incite the formation of antibodies in rabbits. These antibodies precipitated several native proteins but not the branched copolyptides.

The results of the present investigation suggest that these synthetic, water-soluble copolyptides are useful as models for some of the water-soluble proteins.

130 pages. \$1.75. Mic 56-3209

#### CHEMISTRY, INORGANIC

##### THE ELECTRODEPOSITION OF MOLYBDENUM ALLOYS FROM AQUEOUS SOLUTIONS

(Publication No. 19,082)

Donald Warren Ernst, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor M. L. Holt

The electrodeposition of molybdenum with the co-metals, iron, cobalt and nickel, has been accomplished, but the deposition of pure molybdenum from aqueous solutions in appreciable amounts does not seem possible. The purpose of this research was to obtain basic information about the alloy baths which could be examined for some clue as to why the co-metal is necessary for the electrodeposition of molybdenum.

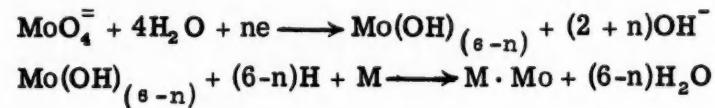
The research may be divided into two parts. The first part was a study of the effect of the various bath constituents, pH, current density and temperature on the cathode current efficiency and the composition of the alloys. The second part was a study of the cathode potential during plating.

In the first part nickel-molybdenum, cobalt-molybdenum, and iron-molybdenum alloys were electrodeposited from aqueous solutions containing sodium molybdate, the sulfate of the codeposited metal, sodium citrate, and ammonium hydroxide. Typical baths were made up with 0.3 M/l of the codepositing metal sulfate, 0.3 M/l of sodium citrate, varying amounts of sodium molybdate, and ammonium hydroxide to pH about 10.5. The maximum amount of molybdenum in the electrodeposited alloys depends on the alloying metal. When a typical bath was used, nickel alloys were found to contain up to 20% molybdenum,

cobalt alloys contained up to 40% molybdenum, and iron alloys contained about 50% molybdenum. The cathode current efficiency in the above cases ranged from 75-85% for the nickel-molybdenum bath, 50-60% for cobaltmolybdenum, and 10-20% for iron-molybdenum.

These electrodeposited molybdenum alloys were metallic and either bright or light gray in appearance, with a large number of cracks in the bright deposits. Adherence of the deposit to well-cleaned flat cathodes seemed to be good, but adherence to tubing or rods was poor; usually these deposits could be brushed off in flake or powder form.

The direct method involving the use of a capillary tip was used to measure the cathode potential during the actual plating of an alloy. Interpretation of the cathode potential data indicates that the reduction of the molybdate ion does not involve six electrons, but only one, two or three, depending upon the co-metal and its oxidation state. It was also reasonable to conclude from the data that hydrogen was involved in the molybdate reduction. From the above study, the following two-step mechanism was proposed.



The above mechanism is unique in that it is a two-step process. Explanations given previously for the reduction of the molybdate ion suggested that hydrogen may be the reducing agent or that overvoltage factors may be involved but none combined the two ideas.

165 pages. \$2.20. Mic 56-3210

##### AN INVESTIGATION INTO CERTAIN REACTIONS BETWEEN TRANSITION METALS AND HETEROCYCLIC COMPOUNDS OF CARBON AND NITROGEN

(Publication No. 17,919)

Earl Allen Gold, Ph.D.  
University of Missouri, 1956

Supervisor: N. C. Nielsen

An attempt was made to prepare compounds having the laminated molecule characteristic of ferrocene, but with heterocyclic rings replacing the cyclopentadiene rings of ferrocene. Pyrrole, imidazole, and triphenyltriazine were studied as ring systems containing one, two, and three nitrogens, respectively.

No evidence was found for formation of compounds having laminate molecules. With imidazole, however, three types of compounds were prepared: Type I, conventional coordination compounds; Type II, salts; and Type III, compounds in which imidazole functions simultaneously as ligand and anion.

Type I compounds were prepared with cobalt, nickel, copper, and cadmium. Type II compounds included nickel, copper, and cadmium. Type III compounds were isolated only with nickel and copper. Iron and chromium did not react under the conditions of these experiments.

Eleven of the compounds prepared, including all Type III compounds, had not previously been reported in the literature. A Type I compound of cobalt,  $\text{Co}(\text{II})(\text{imH})_6(\text{NO}_3)_2$ , was found to exhibit abnormal stability for cobalt(II) coordination compounds. Composition of this complex was confirmed by chemical analysis and magnetic susceptibility.

126 pages. \$1.70. Mic 56-3211

### STUDIES OF RADIODELEMENT FRACTIONATION IN HYDROTHERMAL TRANSPORT PROCESSES AND OF THE CONTRIBUTION OF SOME NUCLEAR REACTIONS TO HYDROTHERMAL ACTIVITY

(Publication No. 16,960)

John Haworth Jonte, Ph.D.  
University of Arkansas, 1956

Major Professor: Raymond R. Edwards

This research program was undertaken as an exploratory study of the relationship of natural radioactivity, natural fission, and induced natural radioactivity to hydrothermal activity, and to the geochemistry of uranium and thorium and their decay products. The springs at Hot Springs National Park, Arkansas, and the cold springs of the surrounding area offered a convenient locus for the field aspects of the investigation.

The studies have fallen into three distinct categories: (1) Natural fission as a source of heat and radioactivity, in thermal waters and in hydrothermal deposits; (2) the induced natural radioactivity of sub-surface chlorine, as an indicator of the contribution of neutron-induced reactions to geothermal processes; and (3) some measurements of isotope ratios of radiodelements in natural waters, as an indication of the relative leaching rates of the various natural decay series.

#### I. Natural Fission as a Source of Heat and Radioactivity

Analyses of the Hot Springs waters for the fission products Sr-89 and Sr-90 yielded values ranging from 2 to  $4 \times 10^{-13}$  curies per liter, with a Sr-89/Sr-90 activity ratio of  $63 \pm 13$ . If equal extraction efficiencies are assumed for Sr and Ra, this level of activity is considerably higher than expected from spontaneous fission alone, since the Ra-226 content of the waters is about  $10^{-12}$  curies per liter, and the calculated Sr/Ra activity ratio at equilibrium is  $5.6 \times 10^{-8}$ .

Contribution of fission Sr from rainwater is distinctly possible, and indeed indicated by the high value of the Sr-89/90 activity ratio, which should be approximately unity for fission products in equilibrium with the source material. That the waters are largely meteoric in origin is indicated by a tritium analysis by W. F. Libby (private communication), showing a value of  $2.5 \pm 1.4$  atoms of tritium per  $10^{18}$  atoms of hydrogen, a typical value for meteoric water in the region. It should be noted, however, that Sr<sup>89</sup> has a longer-lived gaseous antecedent ( $3.2m$  Kr-89) than Sr<sup>90</sup> ( $33s$  Kr-90), and that the Rn-222/Ra-226 activity ratio of about 500 in the waters indicates a much greater efficiency for extraction of the noble gases than of the alkaline earth metal ions. The longer average life of Kr-89 would permit enrichment of the mass 89 decay chain in the waters.

#### II. Neutron-Induced Activity in Natural Chlorine

Chlorine was removed, without added carrier, from Great Bear Lake pitchblende, from Hot Springs water, and from a petroleum brine with an unusually high radium content (about  $10^{-9}$  grams Ra-226 per liter). Final purification was performed by repeated evolution of HCl, trapped in aqueous ammonia, as described by Davis and Schaeffer (BNL-340). Results of the radioactivity measurements, made on an anticoincidence screen-wall counter by R. Davis of Brookhaven, are shown in Table I.

Table I. Specific Activity of Chlorine from Natural Materials

Sample	Wt. $\text{NH}_4\text{Cl}$ on liner (grams)	Counting rate above reference (c/m)	Specific activity (dis/m/g Cl)
Great Bear Lake Pitchblende	0.084	$0.50 \pm 0.08$	$17 \pm 3$
Hot Springs Waters	0.52	$0.32 \pm 0.07$	$2.1 \pm 0.03$
Petroleum Brine	7.8	$2.17 \pm 0.07$	$1.19 \pm 0.04$

Translated to values of "apparent thermal neutron flux," based on an absorption cross-section of 43 barns for Cl-35, these results yield values of 0.5, 0.06, and 0.036 neutrons  $\text{cm}^{-2} \text{ sec}^{-1}$ , respectively, for the pitchblende, hot springs, and petroleum brine samples. Using the best available analyses of these materials and the best available values for capture cross-sections of all elements present, and assuming that thermal capture is the ultimate fate of each neutron produced by ( $\alpha, n$ ) reactions and/or by spontaneous fission, activity values expected for chlorine-36 were calculated, for comparison with the experimental values. The comparison is shown in Table II. A reasonable check is obtained for the pitchblende sample, but the

Table II. Comparison of Calculated and Experimental Cl-36 Activities for Some Natural Materials

Sample	Calculated (disintegrations/minute/gram Cl)	Experimental (disintegrations/minute/gram Cl)
Great Bear Lake Pitchblende	7.6	$17 \pm 3$
Petroleum Brine	$1.3 \times 10^{-5}$	$1.19 \pm 0.04$
Hot Springs Water	$3.9 \times 10^{-3}$	$2.1 \pm 0.3$

aqueous chlorine samples show much more activity than expected. Additional purification of these samples will be attempted before any effort is made to interpret these results.

#### III. Some Isotope Ratio Measurements in Natural Waters

To determine the nature of the source of the radioactivity found in natural waters in the vicinity of Hot Springs, Arkansas (the presence of thoron, radon-222, and radium-226 has already been reported) a search for additional radium isotopes and for thorium and actinium was made. For comparison with the hot spring water, samples of ground water from drill hole No. 1 at the nearby Wilson uranium prospect were obtained. A sample of manganeseiferous pipe scale collected from the pipes of the

Government Free Bath House was also analyzed, and the results compared with those obtained from the water. The ratios found are tabulated in Table III.

Table III. Activity Ratios of Natural Series Elements in Natural Materials

Sample	Ra-228/Ra-226	Ac-227/Th-228 (curies per curie)	Ra-223/Ac-227
Hot Springs Water	0.18 ± 0.02	0.24 ± 0.02	
Drill Hole No. 1			
Wilson Uranium Prospect	0.17 ± 0.02		1.1 ± 0.1
Pipe Scale	0.37 ± 0.04	0.048 ± 0.005	

From these ratios the apparent uranium-235 to uranium-238 series activity ratio for the hot spring water was estimated to be  $0.046 \pm 0.005$ . Compared with the value 0.046 from mass spectrometric data, the result indicates that the hydrothermal system is essentially in a steady state and is reflecting the ratio of the parent nuclides in the source material, and thus that no significant differential leaching of the two series occurs above radium in the decay chains.

These ratios were also used to estimate the concentration of radium-226, radium-228, actinium-227, and thorium-228 in the waters and pipe scale. The ratios combined with a radium-226 standardization curve and the radium isotope conversion factors have the values tabulated in Table IV.

Table IV. Concentration of Radium-226, Radium-228, Actinium-227 and Thorium-228 in Some Natural Waters

Sample	Activity ( $10^{-12}$ curies per liter)			
	Ra-226	Ra-228	Ac-227	Th-228
Hot Springs Water	1.1 ± 0.4	0.34 ± 0.08	0.018 ± 0.008	0.008 ± 0.004
Drill Hole No. 1				
Wilson Uranium Prospect	2.3 ± 0.1	0.40 ± 0.04	0.07 ± 0.3	0.001

The amount of thorium in the source material of the radioactivity of the hot spring water was estimated, using the lower limit for the amount of uranium ( $3.0 \times 10^4$  metric tone, estimated from the radon content and the flow-rate of the springs) and the radium-228 to radium-226 ratio ( $0.18 \pm 0.02$ ). This gave a value of  $1.7 \times 10^4$  metric tons. From the amounts of uranium and thorium, and their average abundance in granitic igneous rocks, the amount of rock represented in each case was estimated. The uranium required about  $8 \times 10^9$  tons of rock, and the thorium required about  $1.3 \times 10^9$  tons of rock. These two values, obtained from two different measurements, are of the same order of magnitude and indicate that the source material for the radioactivity could be a large mass of igneous rock intruded close to the surface.

72 pages. \$1.50. Mic 56-3212

## VOLTAMMETRY USING A CURRENT INTEGRATOR

(Publication No. 18,507)

Evan Morgan, Ph.D.  
University of Washington, 1956

A precision, transient current measuring device, using an electronic current integrator, has been constructed to study the currents flowing at a stationary platinum electrode. The electrolysis was timed by an electronic timer which used line frequency as a time standard. The apparatus integrated either the total period of electrolysis or a portion of the total period.

The system has proved to be amenable to mathematical interpretation, giving close agreement with results calculated from cylindric diffusion theory. The diffusion process was studied by electrolyzing several ions under limiting current conditions. From the range of diffusion coefficients and the length of electrolysis time, it was determined that the system could be described by the laws for cylindrical diffusion theory provided the diffusion layer did not become too large.

The electrode reactions of some reversible systems were studied from the standpoint of cylindrical diffusion. The equations described the system with good accuracy. The formal potentials, determined experimentally, agree closely with those calculated from free energy data.

This method of controlled potential electrolysis is shown to be applicable, as an analytical tool, in concentration measurements, with an accuracy comparable to that of polarography. 79 pages. \$1.50. Mic 56-3585

## STUDIES AT ELEVATED TEMPERATURES OF METAL-CERAMIC SYSTEMS COMPOSED OF NICKEL AND A SOLID SOLUTION OF TANTALUM AND NIOBIUM CARBIDES IN TITANIUM CARBIDE (VOLUMES I AND II)

(Publication No. 18,816)

Herbert William Newkirk, Jr., Ph.D.  
The Ohio State University, 1956

The system nickel-titanium carbide forms a series of solid solutions and mixtures which are ideal for high-temperature applications. Compositions, designated K-151-A and K-152-B, are somewhat brittle, i.e., have poor impact strength, and their strength at high temperatures decreases rapidly with time. Previous investigations in other systems, and particularly in the field of iron metallurgy, have shown that the size, distribution, and shape of the various phases in an alloy have a pronounced effect on the physical and chemical properties of a solid. The study, therefore, was initiated in order to investigate the crystal structure and microstructure of the phases present in samples K-151-A and K-152-B as a function of time at temperature.

One series of samples was heat-treated in a vacuum, and another series in a helium atmosphere, at  $1093^\circ\text{C}$ . ( $2000^\circ\text{F}$ .), All samples were quenched in oil after 50, 100, 200, 300, 500, 700, and 1,000 hours. In addition, diffusion couples, consisting of a small wafer of nickel pressed tightly against either a wafer of K-151-A or K-152-B by

means of a nickel screw and crucible assembly, were constructed. One series of couples was heat-treated at 1093°C. (2000°F.) in a vacuum, and another series was heat-treated at 1093°C. (2000°F.) in a helium atmosphere. All diffusion couples were quenched in oil after 1,000 hours.

Heat-treatment at 1093°C. (2000°F.) for as long as 1,000 hours had no significant effect on the composition, hardness, and crystal structure of the phases present in samples K-151-A and K-152-B. In addition, the density and porosity of the samples remained unchanged. By the use of quantitative metallographic analysis, changes in microstructure were detected in the samples heat-treated for 1,000 hours at 1093°C. (2000°F.) in a helium atmosphere. These changes, although small enough to escape recognition under the optical microscope, result in an increase in the average cross-sectional area and the average linear intercept of the individual nickel particles. A decrease in the surface to volume ratio of the nickel particles was also observed. The mean free path nickel particles, however, did not change.

No diffusion of metal carbide into nickel was detected upon examination of the interface between the diffusion couples. Electron microscopy photographs indicated that small carbide particles, 500Å-2000Å in diameter, were dispersed in the nickel phase of the cermets. Corrosion of the surface of the carbide particles was also noted.

In order to study the crystal structure of the phases present in the cermets K-151-A and K-152-B as a function of temperature, thin fibers 0.006" in diameter x 0.250" in length were made from the slugs mentioned above. These samples were then mounted in a high temperature x-ray diffraction camera, and photographs were taken between room temperature and 1100°C. (2012°F.). In addition, the thermal expansion of nickel wire and extruded titanium carbide were determined.

The nickel phase in the cermets was found to undergo a uniform thermal expansion from room temperature up to approximately 816°C. (1500°F.). Above this temperature a rapid increase in the rate of expansion occurs. No structural changes were observed throughout the entire temperature range. Similarly, the carbide phase in the cermets K-151-A and K-152-B was found to undergo a uniform thermal expansion from room temperatures up to approximately 927°C. (1700°F.). Above this temperature an increase in the rate of expansion occurs. No structural changes were observed throughout the entire temperature range.

Nickel was found to undergo a uniform thermal expansion from room temperature up to the Curie temperature 352°C. (665°F.). A rapid decrease in the rate of expansion occurred within a narrow temperature range as the temperature was increased. Thereafter, the rate of expansion became uniform again up to 1100°C. (2012°F.). No structural changes were observed.

Titanium carbide was found to undergo uniform thermal expansion over the temperature range of this investigation and to undergo no structural change.

510 pages. \$6.50. Mic 56-3223

## CHEMISTRY, ORGANIC

### A STUDY OF THE RATES AND ENERGIES OF REACTIONS OF SOME ISOELECTRONIC SYSTEMS

(Publication No. 19,360)

Charles Allen Blood, Jr., Ph.D.  
Lehigh University, 1956

Experimental work is reported with the purpose of determining the effect of a common activating group upon the halogen reactivity in some isoelectronic systems and also to determine the effect of the heteroatoms upon the halogen reactivity in activated halogen compounds of furan, thiophene and pyridine relative to that observed in the corresponding halobenzenes.

The study was carried out by determining the rates of the nucleophilic displacement of halogen at three or more temperatures and calculating the activation energies and entropies of reaction. The rates were all studied under pseudo-unimolecular conditions with the halogen compound present in a concentration of 0.2 Molar. Piperidine was used as both the solvent and the nucleophilic reagent. Rates are recorded for the reactions of the following compounds: p-bromobenzoyl piperidide, 5-bromothenoyl piperidide, 5-bromofuroyl piperidide, 4-bromo-1-naphthoyl piperidide and 6-chloronicotinoyl piperidide. The activation energies were found to be, respectively:  $23.0 \pm 1.0$  kcal.;  $19.8 \pm 0.4$  kcal.;  $18.1 \pm 1.1$  kcal.;  $21.0 \pm 0.7$  kcal.;  $12.8 \pm 0.3$  kcal.

The results are discussed in the light of the electronic effects of the activating group and heteroatoms upon the various nuclei concerned. A trend toward reversal of halogen reactivity has been observed in activated and nonactivated halofurans and has been explained on the basis of a difference in transition states. Kinetic data on related compounds studied under identical kinetic conditions has been accumulated for the purpose of comparisons and observing trends.

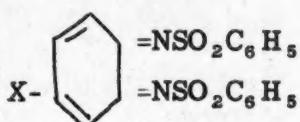
All kinetic products were isolated and analyzed, and configurational proofs of structure were carried out with the p-piperidinobenzoyl piperidide and 4-piperidino-1-naphthoyl piperidide. 124 pages. \$1.65. Mic 56-3213

### I. THE REACTIONS OF O-QUINONEDIBENZENESULFONIMIDES II. THE REACTIONS OF 2,4-DIMETHYL-O-NAPHTHOQUINOLIMIDE ACETATE

(Publication No. 18,128)

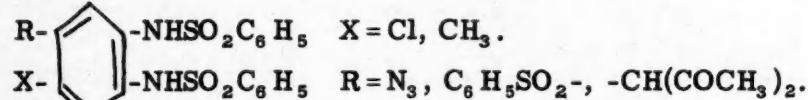
Edwin Lawson De Young, Ph.D.  
University of Illinois, 1956

The investigation of the reactivity of o-quinonediimides has previously been limited to the addition of hydrogen chloride. In view of the large number of addition reactions of the p-quinonediimides, a further study of the reactions of the o-quinonedibenzenesulfonimides has been undertaken. To this end, 4-chloro- (I) and 4-methyl-o-quinonedibenzenesulfonimide (II) were used as starting materials.



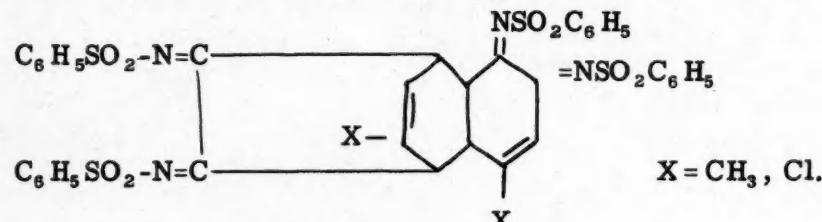
I. X = Cl.  
II. X = CH<sub>3</sub>.

These imides add hydrazoic acid, benzenesulfonic acid, and acetylacetone to give the 5-substituted adducts (III). Only in the case of the hydrazoic acid adducts were the structures established unequivocally. Since the azido group was shown to enter the 5-position, it is assumed that the other adducts have an analogous constitution. Adducts from amines or other active methylene compounds could not be isolated. Diels-Alder reactions apparently did not occur.



III

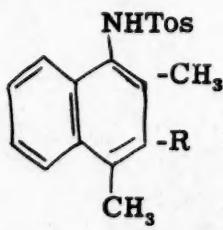
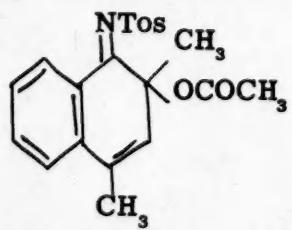
Upon attempted addition of nitromethane and attempted Diels-Alder reactions with cyclopentadiene, these imides were converted to dimers of structure IV.



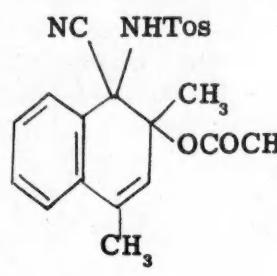
IV.

Quinol imide acetates are similar to quinone imides in their susceptibility to addition reactions. Naphthoquinol-imide acetates add HX reagents like those in the benzo-quinol series. The reagents in the naphthalene series, however, add 1,6 with elimination of acetic acid to give the 3-substituted naphthalenes VI.

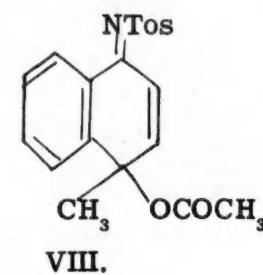
This research was undertaken to study the addition of reagents to 2,4-dimethyl-*o*-naphthoquinol imide acetate (V). Hydrogen chloride, hydrogen bromide, and acetic acid gave 3-substituted naphthalenes VI.



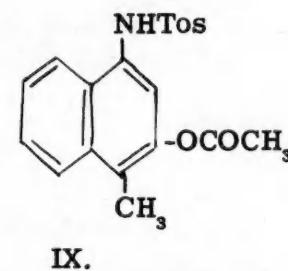
R = Cl-, Br-,  
CH<sub>3</sub>CO<sub>2</sub>-.



VII.



VIII.



IX.

123 pages. \$1.65. Mic 56-3214

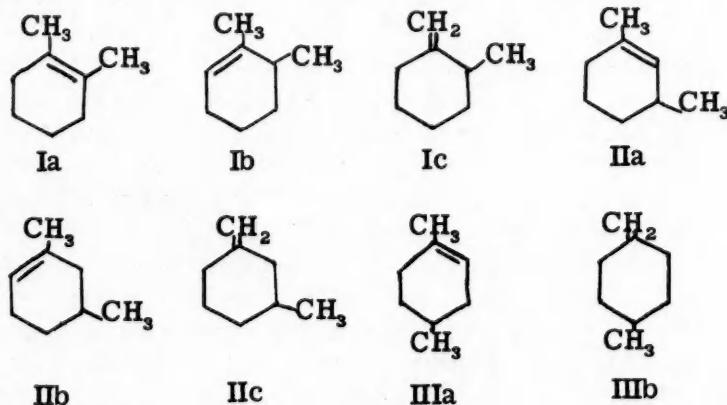
#### THE STEREOCHEMISTRY OF THE CATALYTIC HYDROGENATION OF THE ISOMERS OF DIMETHYLCYCLOHEXENE AND XYLENE

(Publication No. 16,957)

Morris Dunkel, Ph.D.  
University of Arkansas, 1956

Major Professor: Samuel Siegel

Eight isomers of dimethylcyclohexene were catalytically hydrogenated with the intention of deducing the mechanism of the reaction from the stereochemical results obtained. The olefins that were used in this study are:



Olefins Ia, Ib, IIb, and IIIa were obtained by the iodine catalyzed dehydration of 1,2-, 1,3-, and 1,4-dimethylcyclohexanols. The pyrolysis of 2,6-dimethylcyclohexyl acetate or palmitate resulted in the formation of olefin IIa. The exo double bonded isomers (Ic, IIc, and IIIb) were prepared by the pyrolysis of 1,2-, 1,3-, and 1,4-dimethylcyclohexyl acetates.

All of the olefins were hydrogenated at ambient temperature and low pressure (35 pounds/square inch) and in the presence of Adam's platinum oxide catalyst. The solvent was glacial acetic acid. Under these conditions, the rate of hydrogenation appeared to be the same for all the olefins within limits imposed by the apparatus used. The stereochemical results of hydrogenation using other reaction conditions were also investigated.

Addition of hydrogen cyanide proceeded by 1,2-addition to give the product VII. Treatment of VII with concentrated sulfuric acid afforded two products, *p*-toluenesulfonamide, and 1,1'-dicyano-4,4'-dimethyl-2,2'-dinaphthobenzyl ether. Treatment of VII with alcoholic potassium hydroxide resulted in loss of both cyano and acetoxyl groups to give the reduced amide. Attempted addition of methylmagnesium iodide or thiophenol to V resulted in reduction. Apparently no reaction took place with amines, active methylene compounds or benzenesulfonic acid.

The *p*-naphthoquinol imide acetate VIII was synthesized by oxidation with lead tetraacetate of 4-methyl-1-*p*-toluenesulfonamidonaphthalene. Attempts to add hydrogen chloride caused rearrangement to IX.

The ratio of the isomeric dimethylcyclohexanes formed (cis to trans) was determined by analytical distillations and from the infrared spectra of the mixtures produced. Because IIb can be obtained conveniently in its optically active form, the composition of the mixture produced by its hydrogenation was analyzed polarimetrically as well. All methods of analysis agreed within their respective precisions. The percentage of cis isomer produced from each olefin is as follows: Ia, 77; Ib, 70; Ic, 64; IIa, 80; IIb, 69; IIc, 70; IIIa, 54; IIIb, 54. Clearly, the cis isomer predominates in every instance although it is the thermodynamically less stable isomer of the 1,2- and 1,4-dimethylcyclohexanes but is the more stable form of 1,3-dimethylcyclohexane.

The proportion of isomers produced from IIIb was unaffected by changing the solvent to methanol, but varied with different catalysts: nickel, 46 percent cis; palladium, 30 percent cis. Raising the hydrogen pressure to two hundred atmospheres increased the amount of the cis isomer produced from Ia to 86 percent.

Some process other than a simple addition of hydrogen to one side of the olefin must occur since even 1,2-dimethylcyclohexene (Ia) yielded a mixture of geometrical isomers. That this process is not an isomerization of the original olefin to another which returns to the bulk phase is evident since 1,2-dimethylcyclohexene was the only olefin present after half the initial charge had been reduced. This process is not an equilibration of the first formed product because cis-1,2-dimethylcyclohexane was recovered unchanged after a long exposure to the hydrogenation conditions. The trans-1,2-dimethylcyclohexane must, therefore, be formed during some intermediate stage. The formation of a radical at one of the tertiary carbon atoms and a subsequent abstraction of hydrogen from another molecule in the "half-hydrogenated" state is proposed as a possible means of producing the observed mixture.

A number of models were studied by conformational analysis in order to deduce the stereochemistry of the geometry determining transition state. Consideration of the fully chemisorbed state or the various possible "half-hydrogenated" states as geometry determining leads one to predictions that do not agree with the observed results. If the geometry determining transition state is considered to resemble the most thermodynamically stable form of the reactants then the predictions that follow are the most consistent with the experimental facts.

The hydrogenation of the xylenes, using Adam's catalyst, produced mixtures of cis and trans dimethylcyclohexanes: ortho, 96 percent cis; meta, 86 percent cis; para, 74 percent cis. These results cannot be accounted for by the notion that a simultaneous addition of six hydrogen atoms takes place followed by an equilibration of the product since there is no evidence that an equilibration occurs under the conditions used. Moreover, the quantity of trans-1,3-dimethylcyclohexane produced from m-xylene is greater than would be present in an equilibrated mixture (95 percent cis and 5 percent trans). It is more likely that the hydrogenation of the xylenes proceeds through a number of stages; the latter ones in the sequence coinciding with the path taken by the related dimethylcyclohexenes.

74 pages. \$1.50. Mic 56-3215

## THE REACTION OF CYANOGEN WITH SOME ALIPHATIC AND AROMATIC DIAMINES [WITH A] NOTE ON THE CYANOGENATION OF ANILINE

(Publication No. 18,751)

John Richard Fisher, Ph.D.  
The University of Buffalo, 1956

This investigation involved the cyanogenation of the following diamines:

ethylenediamine  
1,3-propanediamine  
1,4-butanediamine (putrescine)  
1,5-pentanediamine (cadaverine)  
1,6-hexanediamine  
1,2-propanediamine  
diethylenetriamine  
3,3'-iminobispropylamine  
p-phenylenediamine  
benzidine

The following facts have been established:

1. Aliphatic diamines react with cyanogen to form sym-bis(aminoalkyl)oxamidines.
2. The sym-bis(aminoalkyl)oxamidines are generally unstable and react further with the elimination of ammonia by an intramolecular or an intermolecular mechanism, depending upon the length of the carbon chain.
3. The hydrochloride salts of the oxamidines are stable.
4. When the carbon chains of the oxamidine have two or three members between the amino groups, the secondary amino groups react with the oxamidine imino groups to eliminate ammonia and form 5 or 6 membered bicyclic compounds. Thus, sym-bis(2-aminoethyl) oxamidine yields bis( $\Delta^2$ -2-imidazolinyl) and sym-bis(3-aminopropyl) oxamidine yields bis( $\Delta^2$ -2-pyrimidinyl).
5. When the carbon chains of the oxamidine have 4 or more members the secondary amino groups react with the imino groups of other molecules to form three dimensional, thermo-setting polymers.
6. Aliphatic compounds containing two primary and one secondary amino group, such as diethylenetriamine and 3,3'-iminobispropylamine, react in ether solution to form cyclic structures, by the elimination of ammonia. Diethylenetriamine yields bis[ $\Delta^3$ -1-(2-aminoethyl)-2-imidazolinyl] and 3,3'-iminobispropylamine yields bis[ $\Delta^3$ -1-(3-aminopropyl)-2-pyrimidinyl].
7. p-Phenylenediamine reacts with cyanogen in the same manner as do aliphatic diamines with four or more carbon atoms. It forms an oxamidine which reacts further intermolecularly with the elimination of ammonia to form a polymer.
8. From the reaction mixture of benzidine and cyanogen it is possible to isolate a cyanoformamidine N(cyanoformimino)benzidine, and an oxamidine, sym-bis-4-(4'aminobiphenyl)oxamidine.
9. The cyanoformamidine reacts with benzidine to yield the oxamidine. 53 pages. \$1.50. Mic 56-3216

A STUDY OF THE SELENIUM-CATALYZED  
CIS-TRANS ISOMERIZATION OF  
9-OCTADECENOIC (OLEIC-ELAIDIC) ACIDS  
(Publication No. 19,287)

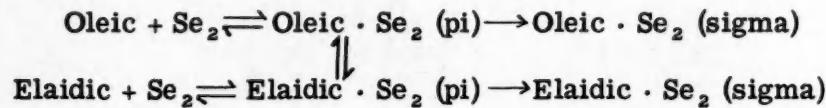
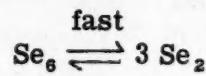
J. D. Fitzpatrick, Ph.D.  
The University of Cincinnati, 1956

The selenium-catalyzed elaidinization of oleic acid proceeds via ( $\pi$ ) complex formation between oleic acid and selenium, resulting in the solution of the selenium. At reaction temperature, this complex undergoes isomerization but concomitantly there is a further reaction to a different species in which the selenium is catalytically inactive and in which the substrate has combined irreversibly with selenium in some type of different (sigma) complex or compound.

At any particular initial concentration of selenium, the standard pseudo first order rate equation for a reversible reaction holds. The full rate equation is most accurately expressed as follows:

$$\text{rate} = k_1 [\text{Oleic}] [\text{Se}_0]^{\frac{1}{3}} - k_2 [\text{Elaidic}] [\text{Se}_0]^{\frac{1}{3}}$$

The proposed mechanism for the isomerization is



The rate of the reverse isomerization of elaidic to oleic acid was found to be slower than the elaidinization. This fact is consistent with the necessity for considering the equilibrium constants between uncomplexed  $\text{Se}_2$  and oleic acid (or  $\text{Se}_2$  and elaidic acid) and the  $\pi$  complexes of the two acids. The requirement of having a particular type of selenium was demonstrated. The high temperatures are probably required for the dissociation of polyatomic selenium.

The generality of  $\pi$  and sigma complexing with unsaturated compounds was established and the analogy between the reaction of selenium and that of oxygen with olefinic compounds was suggested.

102 pages. \$1.50. Mic 56-3217

THE SYNTHESIS AND REARRANGEMENT OF  
9,10-DIHYDRO-10,10-DIMETHYL-9-  
PHENYLPHENANTHRYLIUM PERCHLORATE

(Publication No. 18,529)

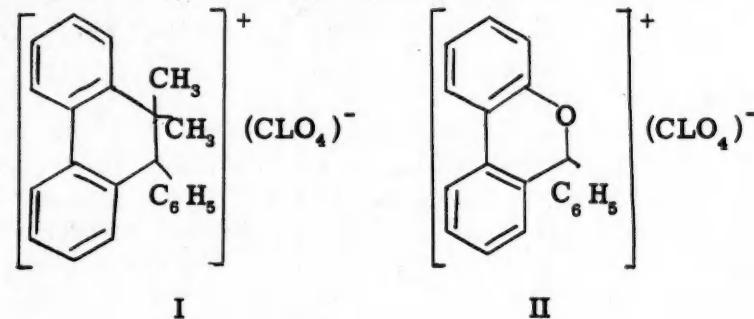
Lothar Ernst Geipel, Ph.D.  
State University of Iowa, 1956

Chairman: Professor R. L. Shriner

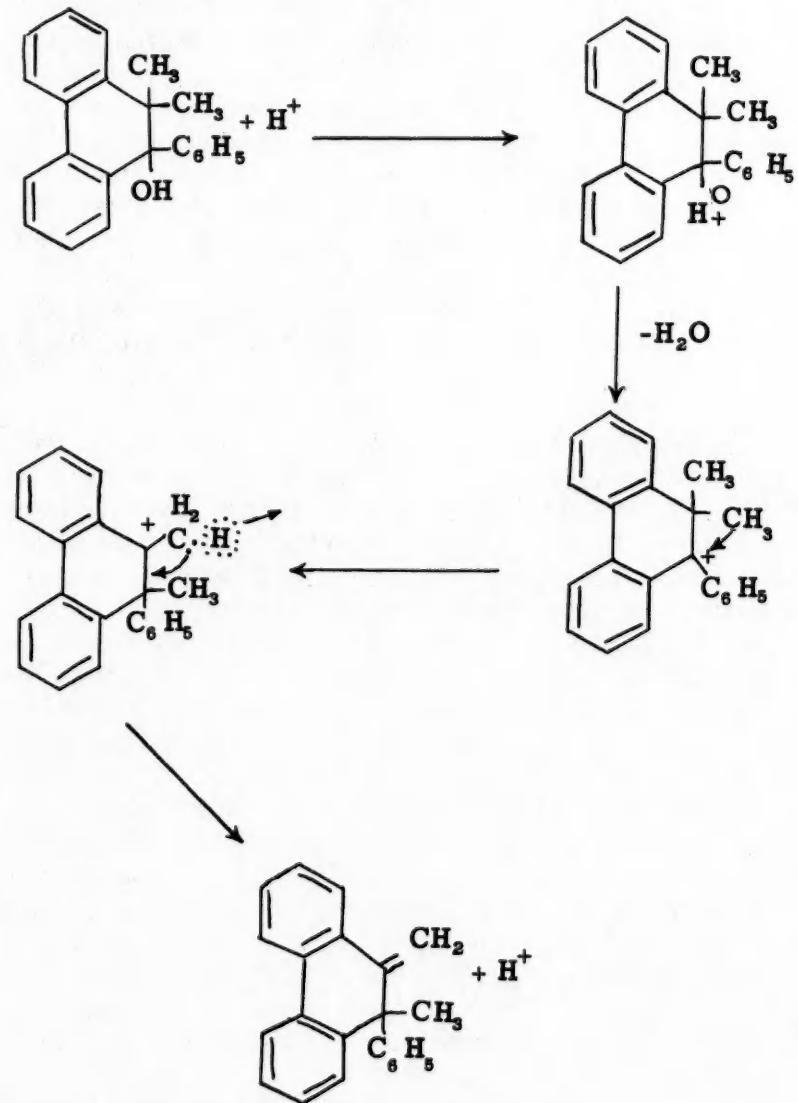
Carbonium salts are often postulated as intermediates in organic reactions, usually contributing to the transition state and hence are of a transitory nature. Certain stable carbonium salts have been isolated, such as triarylmethyl, flavylium, dibenzopyrylium, fluorylium and anthranylium salts. As part of a general study on salts of this type, the

synthesis of a carbonium salt containing a phenanthrene nucleus was studied. Phenanthrylium salts have not been reported in the literature, and thus it was of interest to determine whether stable compounds of this type could be obtained.

Specifically, the object of this investigation was to synthesize the salt, 9,10-dihydro-10,10-dimethyl-9-phenyl-9-phenylphenanthrylium perchlorate (I) and to compare its properties and reactions with 6-phenyl-6-dibenzopyrylium perchlorate (II).



It was of especial interest to determine what effects would be produced by the replacement of the heterocyclic oxygen atom of structure II by the dimethyl-substituted 10-carbon atom of I. This change from a heterocyclic to an isocyclic system would decrease the total possible resonance structures for the cation.



Carbonium salts of the above type are generally prepared by treatment of the corresponding carbinol with concentrated acid. However, when 9,10-dihydro-10,10-dimethyl-9-phenyl-9-phenanthrol was treated with either

concentrated perchloric acid or acetyl chloride, the only product isolated was 9,10-dimethyl-10-methyl-9-methylene-10-phenylphenanthrene, the formation of which can be formulated as shown on the preceding page.

On further treatment with a mixture of hydrobromic and acetic acids, the above methylene compound suffered loss of a methyl group and yielded 9-methyl-10-phenylphenanthrene. Oxidation with chromic anhydride resulted in the formation of 10-methyl-10-phenyl-9(10H)-phenanthrone. The phenanthrone was also prepared as follows: 9,10-phenanthrenequinone was treated with phenylmagnesium bromide to give 10-hydroxy-10-phenyl-9(10H)-phenanthrone in low yield. This hydroxyketone was then treated with an excess of methylmagnesium iodide followed by treatment with acid to yield the phenanthrone.

91 pages. \$1.50. Mic 56-3218

#### THE REACTION OF CYANOGEN WITH AMINOALCOHOLS

(Publication No. 18,752)

Edmond Leonard Graminski, Ph.D.  
The University of Buffalo, 1956

Cyanogen, reacted with an ethyl alcohol solution of ethanolamine, resulted in the formation of sym-bis-(2-hydroxyethyl)-oxamidine. The structure of this compound was determined by analysis and by converting it to sym-bis-(2-hydroxyethyl)-dithioxamide. When the reaction was performed in an aqueous solution the oxamide and the oxaldiimide of ethanolamine were formed in addition to the oxamidine.

The reaction of an ethyl alcohol solution of 2-hydroxy-2-methylethylamine with cyanogen resulted in the formation of a product whose analysis corresponded to the addition of two moles of the aminoalcohol to one of cyanogen. It was assumed to be the oxamidine from its chemical and physical properties.

No pure product could be isolated from the reaction of 3-aminopropanol-1 with cyanogen. The hydrochloric acid salt was unstable and could not be purified, however, since the hydrochloride reacted with n-butylamine to yield tetra-n-butyloxamidine it was concluded that the oxamidine had been produced but was unstable. It was further discovered that sym-bis-(3-hydroxypropyl)oxamide resulted when 3-aminopropanol-1 was reacted with cyanogen in water.

The N-substituted ethanolamines, from N-methyl through N-propyl, when diluted with three parts of ethyl ether, reacted with cyanogen to give unstable products. The hydrochloric acid salts were stable but hygroscopic. The analysis corresponded to the addition of two moles of the aminoalcohol to one mole of cyanogen. Because of their instability in air and in the presence of weak acids it was concluded that the addition took place through the hydroxy group to form oxaldiimides. No product was obtained when N-butylethanolamine was treated with cyanogen.

Ethers of ethanolamine reacted with cyanogen in ethyl alcohol to produce sym-bis-(2-alkoxyethyl)-oxamidines and 3-methoxypropylamine gave sym-bis-(3-methoxypropyl)-oxamidine.

Sym-bis-(2-hydroxyethyl)-oxamidine formed a complex

with copper in the ratio of one mole of oxamidine to one mole of copper salt. A nickel complex was formed also but in the ratio of one mole of nickel salt to two moles of oxamidine. All attempts to form a cobalt complex ended in failure.

48 pages. \$1.50. Mic 56-3219

#### REACTIONS OF BROMOMAGNESIUM ENOLATES

(Publication No. 17,920)

James Leverette Guthrie, Ph.D.  
University of Missouri, 1956

Supervisor: Norman Rabjohn

A number of methyl ketones have been found to yield tribenzoylmethane in about 10% yield when treated with benzoyl chloride in the presence of bromomagnesium *tert*-alkoxides. This reaction appeared to be of interest not only because all three hydrogen atoms of the methyl group are replaced by benzoyl radicals, a phenomenon which apparently has not been observed previously, but because the original acyl grouping is eliminated. Although a fair effort was made in regard to the latter aspect of the reaction, it was not possible to account for the fate of the acyl group, owing in part, at least, to the complexity of the mixtures obtained.

A more extensive investigation of the benzylation of methyl *n*-hexyl ketone showed that the tertiary bromomagnesium alkoxides serve as enolizing agents, and that the ketone enolates are the reactive species in the multiple benzylation reaction. Among the products identified were the enol benzoate of tribenzoylmethane, an  $\alpha,\beta$ -unsaturated ketone formed by the ketolization and dehydration of methyl *n*-hexyl ketone, two unidentified halogen-containing compounds which gave the correct analytical figures for  $C_8 H_{17} OBr$  and  $C_8 H_{17} OCl$ , and the enol enanthate of tri-benzoylmethane. The latter compound was the only substance isolated which incorporated the eliminated acyl group. It was thought at first to be the intermediate tetra-ketone, enanthyltribenzoylmethane, which would have been the first example of a tetraketomethane structure, but it was later shown to be the isomeric enol ester.

From the investigation of the multiple benzylation reaction, it became apparent that bromomagnesium *tert*-alkoxides are quite potent enolizing agents, and a study of bromomagnesium *tert*-butoxide in particular has shown that it is capable of bringing about condensations of the aldol type. For example, methyl *n*-hexyl ketone can be dimerized in 60% yield by the use of this reagent, and dypnone is formed in similar yields by the self-condensation of acetophenone by a procedure which seems much less involved than the standard method which employs potassium *tert*-butoxide. In the hope that solid bromomagnesium *tert*-butoxide would be a stable, effective condensing agent, some of it was isolated, kept for a considerable period of time, and used with success in several condensations.

It was thought that bromomagnesium enolates of methyl ketones might behave as Grignard reagents and undergo alkylation, carbonation, and reactions with esters, but it was found that their utility is apparently limited to reactions with carbonyl compounds. Since these enolates

incorporate the carbonyl group and the halomagnesium function in the same molecule, their reactions with carbonyl compounds leads to the formation of  $\beta$ -hydroxy ketones or the corresponding dehydration products. The bromomagnesium enolate of acetophenone reacts with benzaldehyde to form chalcone in 58% yield, and the corresponding enolate of acetomesitylene reacts with benzaldehyde to produce benzalacetomesitylene in 75% yield. The novel molecule, 1,4-dibenzoyl-2,3-dihydroxy-2,3-diphenylcyclohexane was synthesized through the condensation of benzil with the di-bromomagnesium enolate of 1,4-dibenzoylbutane. Although the yield in this case was only 31%, the reaction illustrates the principle that bromomagnesium *tert*-butoxide, being incapable of addition to the carbonyl group, can replace the  $\alpha$ -hydrogen atoms with the MgBr grouping, leaving the carbonyl group intact in the products of addition reactions.

In addition, it has been found that tribenzoylmethanes can be quantitatively hydrolyzed to dibenzoylmethanes and benzoic acids by boiling with acetic or formic acids. The effect of *para*-substituents on the direction of the cleavage has been studied by observing the hydrolyses of *p*-nitro-, *p*-methoxy-, and *p*-chlorotribenzoylmethane and it has been found that the more negative aroyl group is the more labile. It was observed that Eastman's formic acid behaves anomalously in this reaction, giving 1,1,3,3-tetrabenzoylpropanes instead of the expected dibenzoylmethanes. These products are those which would be expected from a Knoevenagel reaction between dibenzoylmethanes and formaldehyde, but formaldehyde did not appear to be present in the formic acid. Ethyl benzoylacetate did not give a Knoevenagel product when similarly treated, indicating that a very active methylene hydrogen atom is required in this reaction.

138 pages. \$1.85. Mic 56-3220

#### THE CHEMISTRY OF 2-ALKOXYFURANS AND THE KINETICS OF NUCLEOPHILIC DISPLACEMENT OF 2-HALOFURANS

(Publication No. 19,365)

Donald George Manly, Ph.D.  
Lehigh University, 1956

The synthesis of a series of 2-alkoxyfurans has been accomplished by decarboxylation of the corresponding 5-alkoxy-2-furoic acids which were prepared by reacting the appropriate sodium alkoxide with an ester of 5-bromo-2-furoic acid followed by saponification to the acid. The reactions involving the sodium alkoxide were carried out in excess alcohol as the solvent at temperatures of at least 100°C with complete exclusion of moisture. Reduction of the 5-alkoxy-2-furoate with lithium aluminum hydride produced the 5-alkoxy-2-furfuryl alcohol and ammonolysis produced the amide. Attempted nitration of the alkoxy acid was unsuccessful as were the attempts to brominate alkoxyfurans. The ring opening reaction of the alkoxyfurans in methanol produced the dimethyl acetal of  $\beta$ -formylpropionate, mercuration gave only a trimercurated product, and metallation occurred at the 5-position. The extreme acid sensitivity of the alkoxyfurans is compared with ketene-acetals and the analogous thiophenes. A thiophenoxyfuran was also prepared by the same method and this was converted to the previously unknown furan sulfone.

The ultraviolet spectra of many 2-substituted and methyl 5-substituted-2-furoates are reported and some theoretical discussion of the results as compared with the corresponding benzene derivatives is given.

Attempts to obtain quantitative evidence for the "inertness" of 2-halofurans by studying the kinetics of the nucleophilic displacement with piperidine have failed. However it was found that 2-iodofuran does not undergo the standard displacement reaction but proceeds through an entirely different reaction mechanism. The possibility of a furyne intermediate is discussed along with the possibility of a 2,5-addition of piperidine to the furan ring. The kinetics of 5-methyl-2-iodofuran strongly suggest that the 2-iodofuran reaction proceeds by a two or three step reaction involving 2,5-addition.

100 pages. \$1.50. Mic 56-3221

#### PART I: THE STEREOCHEMISTRY OF THE CONVERSION OF ORGANIC CHLORIDES TO ACIDS VIA THE GRIGNARD REAGENTS

#### PART II: SYNTHESIS OF COMPOUNDS RELATED TO MORPHINE

(Publication No. 19,114)

Fred Harold McCarron, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor Harlan L. Goering

The literature contains conflicting reports on the stereochemistry of the conversion of alkyl halides to acids via the Grignard reagents. To obtain additional information on the stereochemical course of the Grignard reaction, the stereochemistry of the conversion of halides to acids by carbonation of the Grignard reagents was investigated using the following chlorides: (a) optically active 3,3-dimethylcyclohexyl chloride, (b) *cis*- and *trans*-3-methylcyclohexyl chloride and (c) *cis*- and *trans*-5-methyl-2-cyclohexenyl chloride. In the first system any degree of stereospecificity would be manifested by an optically active product. In the other two systems epimeric chlorides are involved and if the reaction is stereospecific the epimers would give products with different configurational compositions.

The Grignard reactions were carried out using the mildest conditions possible and the resulting Grignard reagents were carbonated by pouring over Dry Ice. It was found that when the optically active 3,3-dimethylcyclohexyl chloride was converted to the Grignard reagent and carbonated, the product 3,3-dimethylcyclohexanecarboxylic acid was completely inactive. The mixtures of *cis*- and *trans*-3-methylcyclohexanecarboxylic acid derived from the isomeric 3-methylcyclohexyl chlorides had the same configurational composition, and consisted of 26  $\pm$  5% of the *trans* isomer. Similarly the acidic products from *cis*- and *trans*-5-methyl-2-cyclohexenyl chloride had the same configurational composition; 68  $\pm$  5% of the *trans* isomer. Control experiments showed that the loss of stereospecificity occurred during rather than prior or subsequent to the Grignard reaction.

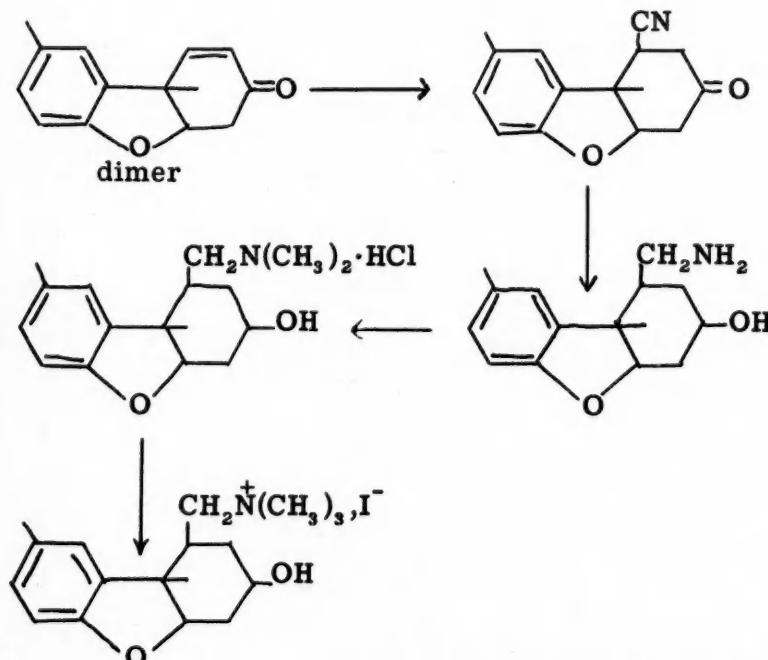
From the present results it is concluded that the conversion of halides to acids via the Grignard reagents is not stereospecific, i.e. epimeric or enantiomeric halides

give the same products. Evidently epimeric or enantio-meric halides give the same Grignard reagent or mixture of Grignard reagents.

In the course of the above investigation, it was found that the reaction of phosphorus pentachloride with several secondary alcohols in chloroform at room temperature results in the formation of vicinal dichlorides together with the expected monochloride. The reaction is stereospecific in that only *trans*-vicinal dichlorides are formed from cycloalkanols. Control experiments demonstrate that the monochloride is not an intermediate in the formation of dichlorides. The formation of dichlorides takes place by a stereospecific mechanism which is discussed.

### Part II

The synthesis of compounds structurally related to morphine was investigated by an extension of a method used to prepare 5-methyl-2-cyclohexenol. This approach was unsuccessful as the condensation to form the necessary intermediate 5-phenyl-5-methyl-1,3-cyclohexanediones failed. Attention was turned to compounds derived from the "dimer" of *p*-cresol (4a,9b-dihydro-8,9b-dimethyl-3(4)dibenzofuranone). The following series of reactions was carried out. Each of the steps is discussed in detail.



114 pages. \$1.50. Mic 56-3222

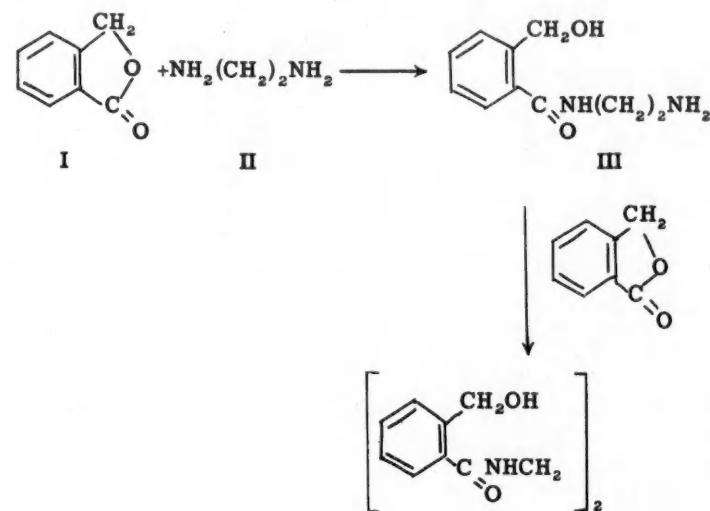
### THE REACTIONS OF ETHYLENEDIAMINE WITH PHTHALIDE

(Publication No. 17,486)

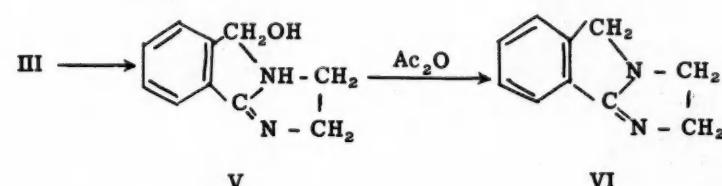
John Carlton Saam, Ph.D.  
State University of Iowa, 1956

Chairman: Professor Ralph L. Shriner

Ethylenediamine and phthalide could react to give either III or IV. The predominance of one product or the other would depend upon the mole ratio of the two reactants and the relative rates of the two reactions shown below.



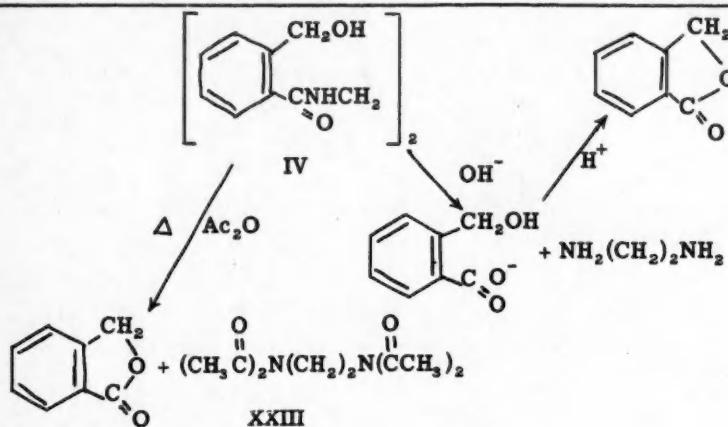
In 1918 Bistrzycki and Schmutz reported the bis-amide, IV, to be the only product; whereas in 1930 Betrabet and Chakravarti reported the product to be III. The later authors were able to convert III to the imidazoline, V, by merely heating compound III in ethanol. By heating in acetic anhydride V was then converted to 2,3 dihydro-5-imidazo-(2,1-a)-isoindole (VI).



It would then be of interest to establish the nature of the products of the reaction of ethylenediamine with phthalide since the tricyclic compound, VI, of Betrabet and Chakravarti's sequence could possess interesting physiological properties.

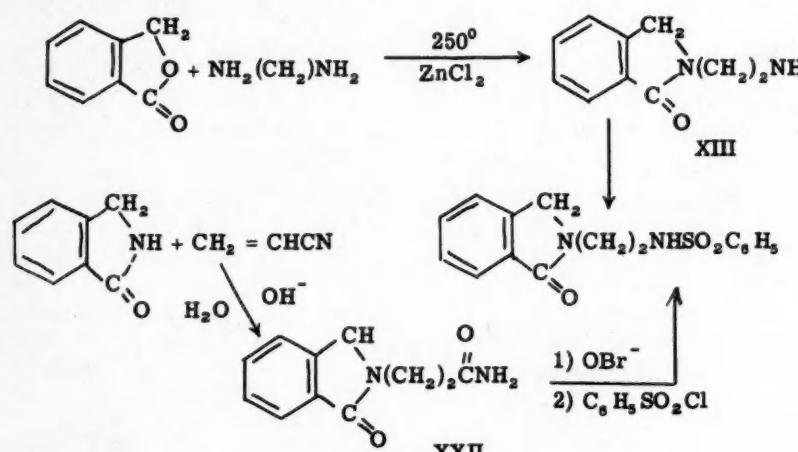
The present investigation revealed, however, that the only product resulting from the reaction of ethylenediamine and phthalide in neutral solutions at room or reflux temperature was the N,N'-ethylenebis-(*o*-hydroxymethylbenzamide) (IV) reported by Schmutz and Bistrzycki. This product's structure was established by the identification of its hydrolysis products as phthalide and ethylenediamine and by its conversion to the diacetyl derivative. The bis-amide, IV, was also cleaved in boiling acetic anhydride to phthalide and tetraacetylene diamine (XXIII) which possessed nearly the same melting point as that reported by Betrabet and Chakravarti for the tricyclic compound, VI, obtained from a similar reaction. Since the tetraacetyl ethylenediamine (XXIII) had not been previously reported, an authentic sample was prepared by the direct action of acetic anhydride on ethylenediamine.

When ethylenediamine and phthalide were heated to 230°-250° in the presence of zinc chloride 2-(2-aminoethyl)phthalimidine (XIII) formed. The structure of this compound was established by the comparison of its benzene-sulfonyl derivative with an authentic sample prepared by an independent synthesis. This was accomplished by cyanacetylation of phthalimidine followed by hydrolysis of the resulting nitrile to 2-phthalimidine-2-propionamide (XXII) in the basic reaction medium. The amide, XXII, was then treated with sodium hypobromite followed by



benzenesulfonyl chloride to yield benzenesulfonyl-2-(2-aminoethyl) phthalimidine (XX).

Alternate routes to 2,3-dihydro-5-imidazo-(2,1-a)-isoindole were also explored.



54 pages. \$1.50. Mic 56-3224

#### THE REARRANGEMENT OF 2-(*p*-ANISYL)-1,2-DIPHENYLETHYLENE GLYCOL ESTERS

(Publication No. 18,196)

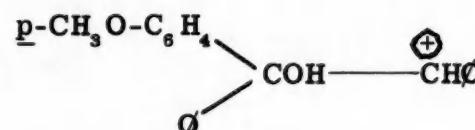
Francis Matthew Scheidt, Ph.D.  
University of Illinois, 1956

It is known that the diastereoisomeric 1-*p*-anisyl-1,2-diphenyl-2-aminoethanols when treated with nitrous acid rearrange stereospecifically as do the diastereoisomeric 1-*p*-chlorophenyl-1,2-diphenyl-2-bromoethanols when treated with silver nitrate in aqueous ethanol. On the other hand it has been shown that 1,2,2-triphenylethanol and its derivatives and the arylsulfonates of the diastereoisomeric 1-*p*-anisyl-1-phenyl-2-propanols, the 1,1-diphenyl-2-propanols, and the 1-*p*-chlorophenyl-1-phenyl-2-propanols rearrange in a non-stereospecific manner. The purpose of the present investigation has been to study the stereospecificity and the mechanism involved in the rearrangement of the diastereoisomeric 2-(*p*-anisyl)-1,2-diphenylethylene glycol esters (esters of *erythro*-I and *threo*-I).

The chloroacetate esters of *erythro*-I and *threo*-I have been prepared. Heating these esters in dry dimethylformamide at 110° causes each of them to rearrange to *p*-anisyldeoxybenzoin (ketone II-A) with no evidence of the formation of the isomeric *p*-anisylbenzhydryl ketone (ketone II-B).

A kinetic study has been made, and it has been found

that both the chloroacetate of *erythro*-I and that of *threo*-I rearrange at about the same rate. It has been found that the *erythro*-ester does not rearrange to ketone II-A via isomerization to the chloroacetate of *threo*-I. Similarly it has been found that the *threo*-ester does not rearrange to ketone II-A by way of rapid isomerization to the chloroacetate of *erythro*-I. Ketone II-B has been found to be stable in the reaction medium, therefore the rearrangement of the *erythro*-ester does not first yield ketone II-B followed by isomerization to ketone II-A. Through the use of carbon-14 labeled *erythro*-ester it has been found that this ester (a sec-ester) does not isomerize to a tert-ester which could then rearrange to ketone II-A with loss of chloroacetic acid and hydrogen migration. Consideration of the above indicates that the rearrangement of each of these chloroacetates goes through the open carbonium ion



followed by *p*-anisyl migration, and loss of a proton to give II-A.

The acetates (III) and 3,5-dinitrobenzoates (IV) of *threo*-I and *erythro*-I have been prepared and partially successful attempts have been made to rearrange IV in dimethylformamide, aqueous dioxane and dioxane plus formic acid, and III and IV in glacial acetic acid. Attempts to prepare the trifluoroacetates and *p*-bromobenzenesulfonates of I have been unsuccessful—instead of the desired ester, the product in each case has been ketone II-A.

90 pages. \$1.50. Mic 56-3225

#### AN INVESTIGATION OF THE STEREOCHEMISTRY AND SYNTHESIS OF THE SPARTEINE FAMILY OF ALKALOIDS

(Publication No. 17,282)

Hanna Suss, Ph.D.  
University of Pennsylvania, 1956

Supervisor: Dr. Marvin Carmack

(-)Spartalupine was isolated for the first time by Carmack and Martin<sup>1</sup> in 1948 from *Lupinus sericeus* Pursh. The physical properties of the new alkaloid are very similar to those of (-)sparteine and it was proven to be one of the predicted, but hitherto unknown, stereoisomers of sparteine. As proof of structure Carmack and Douglas,<sup>2</sup> converted (-)spartalupine to (+)sparteine and (+) $\alpha$ -isosparteine according to the method of Winterfeld and Rauch.<sup>3</sup>

#### Oxidation of Spartaupine

In 1953, Marion, Leonard, and Moore<sup>4</sup> isolated lupanine,  $C_{15}H_{24}O_2N_2$ , a hydroxy-lactam with the same stereochemical configuration as spartalupine. During the structure determination of lupanine, Moore and Marion<sup>5</sup> oxidized the oxygen-free base, obtained by reduction with lithium aluminum hydride, to an oxo-derivative (a lactam) by means of alkaline potassium ferricyanide. It occurred

to us that a similar oxidation would afford an excellent means of further characterizing our (-)spartalupine and relating it to the base,  $C_{15}H_{26}N_2$ , obtained by the Canadian workers from lupanine.

Moore and Marion<sup>5</sup> oxidized spartalupine with four moles of potassium ferricyanide in the presence of two moles of sodium hydroxide and obtained 10-oxospartalupine. When we oxidized naturally occurring (-)spartalupine under similar conditions, we obtained (-)oxospartalupine. This was found to have the same properties as the oxospartalupine obtained by the Canadians in two operations from lupanine.

We established the structure of (-)oxospartalupine in two ways. First this oxo-compound was oxidized with an additional four moles of potassium ferricyanide and two moles of potassium hydroxide to a dioxo-compound whose structure was proven by synthesis (see below). The (-)oxospartalupine was also converted to (+)oxosparteine by the method used by Winterfeld and Rauch<sup>3</sup> to convert (-)sparteine to (-) $\alpha$ -isosparteine.

Since spartalupine has a two-fold axis of symmetry with the  $C_{10}$ -position equivalent to the  $C_{17}$ -position, we considered it possible that a second carbonyl group could be introduced. Treatment of (-)spartalupine with eight moles of potassium ferricyanide and an excess of potassium hydroxide yielded directly a single (-)dioxospartalupine, isolated as the crystalline monohydrate,  $C_{15}H_{22}O_2N_2 \cdot H_2O$ . This dioxo-compound is the same compound obtained by the oxidation of (-)oxospartalupine.

The structure of (-)dioxospartalupine was proven by its synthesis. ( $\pm$ )10,17-Dioxospartalupine is one of the intermediates in the synthesis of ( $\pm$ )spartalupine. Comparison of the synthetic and the (-)dioxo-compound proved conclusively the structure of (-)10,17-dioxospartalupine.

#### Synthesis of Spartalupine

As the final proof of structure of (-)spartalupine, all three possible racemic bases corresponding to the sparteine structure were synthesized and identified with the natural, optically active isomers by means of infrared absorption spectra.

Before we undertook the synthesis, all previous syntheses of the sparteine ring system were reviewed. On the basis of stereochemical considerations we devised our own synthesis incorporating the work of Sorm and Keil.<sup>6</sup> The synthesis was achieved by the catalytic hydrogenation of dimethyl 2,4-di( $\alpha$ -pyridyl)glutarate to the corresponding dipiperidyl ester. Some of the stereoisomers thus formed were cyclized to the tetracyclic bis-lactams upon heating, and from the distilled product there were separated by fractional crystallization three isomeric dioxo-compounds,  $C_{15}H_{22}O_2N_2$ . These were reduced to the free ( $\pm$ )bases with lithium aluminum hydride. Comparison of the infrared spectra of the liquid ( $\pm$ )bases with those of the naturally occurring optically active bases and the preparation of derivatives made identification possible. The dioxo-compound melting at 173-173.5° was reduced to ( $\pm$ )spartalupine, dipicrate m.p. 220.5-221°, monoperchlorate m.p. 185-186°. The second dioxo-compound, melting at 132-133.5°, yielded ( $\pm$ )sparteine upon reduction. The dipicrate melted at 208.5-209.5. The third dioxo-compound, m.p. 159-160°, was isolated as the crystalline hydrate. Reduction yielded ( $\pm$ ) $\alpha$ -isosparteine monohydrate, which was identified by means of infrared spectra.

Thus we have accomplished the synthesis of

spartalupine, and successfully completed the structure proof of the last of the alkaloids of the sparteine family.

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#### COPOLYMERIZATION REACTIONS OF 1,2-DI(2-PYRIDYL)ETHYLENE

(Publication No. 18,209)

Adelbert Thomas Tweedie, Ph.D.  
University of Illinois, 1956

In order to further evaluate the effect of symmetrically substituted ethylenic comonomers on elastomers derived from butadiene copolymers, *trans*-1,2-di(2-pyridyl)ethylene has been prepared and copolymerized. This ethylene was first prepared by Harries and Lenart by the condensation of 2-picoline with pyridine-2-aldehyde.<sup>1</sup> More satisfactory syntheses were found for this compound. The first was by condensation of 2-picollyllithium and pyridine-2-aldehyde. The second involved condensation of N-methylpicoliniumiodide with pyridine-2-aldehyde and subsequent decomposition of the monomethiodide of 1,2-di(2-pyridyl)ethylene to the free base. The *trans* configuration about the double bond was assigned on the basis of the infrared spectrum of the compound.

In the Mutual recipe with butadiene, 1,2-di(2-pyridyl)ethylene was found to be more reactive than stilbene. About 8 per cent was the highest incorporation found for the dipyridylethylene with butadiene even for a 20/80 charge ratio. Evaluation of vulcanizates by the government laboratories, Akron, Ohio, of a 95/5 butadiene/dipyridylethylene copolymer showed that they had no outstanding characteristics. Reactivity ratios for *trans*-1,2-di(2-pyridyl)ethylene were found as follows: with styrene;  $r_1 = 1.85 \pm 0.1$ ,  $r_2 = 0.17 \pm 0.1$ ; with acrylonitrile;  $r_1 = 0.95 \pm 0.05$ ,  $r_2 = 0.02 \pm 0.05$ .

Several dimethyl sulfate quaternized 75/25 butadiene/2-vinylpyridine copolymers were made and evaluated by the government laboratories. In general, the quaternary salt treatment produces greatly improved oil resistance at the expense of good processing, stress-strain, and low temperature properties.

By the reaction of 1,2-di(2-pyridyl)diketone with hydrazine hydrate a new compound, probably 1,2-di(2-pyridyl)diimine has been isolated. An intermediate, which appears

to be 1,2-di(2-pyridyl)-1,2-dihydrazinoethane-1,2-diol, was isolated. This gives the diimine on warming. The corresponding phenylhydrazine derivative, 1,2-di(pyridyl)-1,2-di(phenylhydrazino)ethane-1,2-diol, is more stable and yields the monophenylhydrazone of 1,2-di(2-pyridyl) diketone on warming.

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83 pages. \$1.50. Mic 56-3227

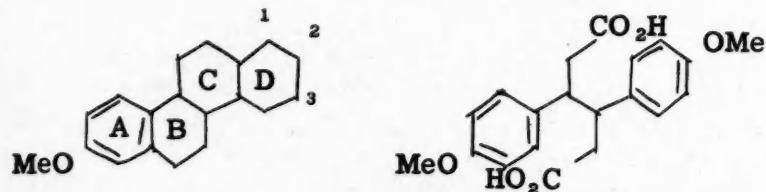
I: THE CONFIGURATION AT THE  
B/C RING FUSION OF ESTRONE  
II: EXPERIMENTS ON THE ELABORATION  
OF THE CORTISONE SIDE CHAIN

(Publication No. 17,354)

William David Wood, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William S. Johnson

Part I. The  $\alpha$ -isomer of 1-keto-8-methoxy-1,2,3,4,4a,4b,5,6,10b,11,12,12a-dodecahydrochrysene (I: 1=O) (W. S. Johnson, et al., J. Am. Chem. Soc., 74, 2832 (1952)) has been converted into cis-2,8-dimethoxy-4b,5,6,10b,11,12-



hexahydrochrysene (I: ring D aromatic, 2-OMe). Since the  $\beta$ -isomer of the ketone (I: 1=O) is known to differ from the  $\alpha$ -isomer of the ketone (I: 1=O) only at the B/C ring juncture, and the  $\beta$ -isomer of the ketone (I: 1=O) has been transformed into natural estrone, the present work proves the B/C ring fusion of natural estrone to be trans. Further, since cis- and trans-2,8-dimethoxyhexahydrochrysene have been prepared from the dl and meso-forms of the diacid II, the present work constitutes the first correlation of natural estrone with a compound of established configuration in the classical sense.

The conversion of the tetracyclic ketone (I: 1=O) to cis-2,8-dimethoxyhexahydrochrysene was performed as follows. The furfurylidene derivative (I: 1=O, 2=CHC<sub>4</sub>H<sub>3</sub>O) of the ketone (I: 1=O), when reduced with sodium borohydride, yielded the furfurylidene alcohol (I: 1  $\beta$ -OH, 2=CHC<sub>4</sub>H<sub>3</sub>O), which, when acetylated and ozonized, yielded two ketol acetates, (I: 1  $\beta$ -OAc, 2=O) and (I: double bond between rings B and C, 1  $\beta$ -OAc, 2=O). Bromination of the first of these yielded the  $\alpha$ -acetoxy- $\alpha'$ -bromoketone (I: 1  $\beta$ -OAc, 2=O, 3  $\alpha$ -Br), which was simultaneously dehydrobrominated and dehydroacetoxylated by heating with dimethyl formamide saturated with lithium chloride. Methylation of the product of this reaction yielded cis-2,8-dimethoxyhexahydrochrysene (I: ring D aromatic, 2-OMe).

Part II. A new method has been devised for the elaboration of the cortisone side chain on cyclohexanone. The ketone was subjected to a glycidic ester condensation, and

the product was converted into 1-cyclohexeneglycolic acid (W. S. Johnson, et al., J. Am. Chem. Soc., 75, 4995 (1953)). Treatment of the methyl ester of this acid with monoperphthalic acid yielded methyl 1,2-epoxycyclohexaneglycolate, which was reduced with lithium aluminum hydride to 1-(1,2-dihydroxyethyl)-cyclohexanol. Oxidation of the 2-benzoate of this triol with chromium trioxide yielded, after saponification, the known 1-hydroxyacetylcylohexanol. Application of this method to dehydroepiandrosterone failed at the glycidic ester stage.

Though a Stobbe condensation with methyl  $\beta$ -cyanopropionate on benzophenone yielded 3-cyano-4,4-diphenyl-3-butenoic acid, condensations on dehydroepiandrosterone, its benzoate and its tetrahydropyranyl ether failed. Attempted alkylation at C-20 of ethyl 3  $\beta$ -acetoxy-20-cyano-pregna-5,17-dien-21-oate with ethyl chloroacetate was unsuccessful.

134 pages. \$1.80. Mic 56-3228

#### CHEMISTRY, PHARMACEUTICAL

SYSTEMATIC SEPARATION OF THE  
SABADILLA ALKALOIDS

(Publication No. 17,329)

Hyman Mitchner, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Lloyd M. Parks

With the aid of recent separation techniques, it was found possible to systematically separate the alkaloids of Schoenocaulon officinale and to study the pure components obtained. The principal method used in separation was counter-current distribution. The alkaloids that were investigated were found to behave ideally in that there existed a linear relationship between the log of the partition coefficient, K, and the pH ( $\log K = pH - Constant$ ). The constant of this equation was found to be specific for each of the alkaloids and there existed a progression of values for the alkaloids which was used as a means of identification, designating the constant as the "Alkaloidal Spectrum" (A.S.) value. Since the partition coefficient was not found to be entirely a function of pH, it was necessary to use a reference partition system and this was chloroform/0.5 M phosphate buffer except for cevadine and veratridine where 0.5 M citrate buffer had to be substituted. The alkaloids isolated or identified had A.S. values of:

veratridine (‡)	3.56
cevadine (‡)	4.3
cevacine (‡)	5.88
sabadilline	6.64
sabatine (‡)	7.3
?	7.69
veracevine (‡)	8.2
?	8.69
sabine	9.0
?	9.43

A number of the alkaloids (‡) were previously reported in the literature. Sabadilline was the name used to designate

an alkaloid with an ultra-violet spectrum with a maximum at 238 mu. Sabine was shown to be the natural alkamine of sabatine. The other alkaloidal substances were not isolated as pure components. Their A.S. values were determined from counter-current distribution data but they were not further investigated as they occurred as only a very small percentile of the total alkaloids. In the course of the work veracevine was isomerized to cevagene and cevine, the isomers separated by counter-current distribution and A.S. values of 8.6 and 7.4 assigned to cevagene and cevine respectively.

The ideal behavior of the alkaloids made possible the development and use of a simplified expression for predicting the number of transfers necessary to attain a desired separation. This was applied to separations of cevadine and veratridine with benzene/phosphate buffers and chloroform/citrate buffer systems. The best conditions for counter-current distribution were applied to the separation of cevadine and veratridine on silicic acid partition columns. Where the partition coefficients were sufficiently far apart, as in the chloroform/citrate buffer system, separation on columns was possible. Using benzene/phosphate buffer separation on a column was not possible. The work on cevadine and veratridine led to the development of a method of analysis for the two alkaloids based on ultra-violet spectral ratios.

Sabatine, which had been previously isolated with chloroform in its crystal structure was obtained in a pure and crystalline form from acetone and water. A new formula,  $C_{29}H_{45}O_8N$ , was assigned. Sabatine was found to be a monoacetate ester of an alkamine, sabine, as had previously been reported. Both mild and strong hydrolytic conditions resulted in the formation of the same alkamine and the formula,  $C_{27}H_{43}O_7N$ , was assigned. Neither sabatine nor sabine reduced triphenyltetrazolium chloride even under accelerated reaction conditions such that cevine reduced the reagent. It is believed that sabatine does not possess the masked secondary  $\alpha$ -ketol hemiketal system reported for other veratrum alkaloids such as germine, veracevine and protoverine.

247 pages. \$3.20. Mic 56-3229

## CHEMISTRY, PHYSICAL

### THE RATE OF EVAPORATION OF WATER THROUGH FATTY ACID MONOLAYERS

(Publication No. 19,261)

Robert James Archer, Ph.D.  
Columbia University, 1954

The influence of fatty acid monolayers on the rate of evaporation of water has been studied by measuring the rate of absorption of water vapor by a solid desiccant suspended above the water surface. An analysis of the transport of water from the liquid phase to the desiccant results in an expression relating the rate of absorption to the absolute condensation rate at the water surface. The expression derived was tested by measuring the rate of absorption as a function of the separation between the desiccant and water surfaces and was proved valid. The

reciprocal of the specific rate constant for condensation is defined as the specific evaporation resistance which, from another point of view, is inversely proportional to the condensation coefficient. Specific resistance was measured for the  $C_{17}$ ,  $C_{18}$ ,  $C_{19}$ , and  $C_{20}$  saturated fatty acids as a function of surface pressure.

Evaporation resistance is very sensitive to the technique used for forming the monolayers. The source of this sensitivity was traced to the occlusion of impurities, principally spreading solvent molecules. A technique was developed which apparently eliminates this effect. The sensitivity of resistance measurements to small occlusion concentrations indicates their utility in studying the structure of monolayers. For example, one percent of occluded benzene in a nonadecanoic acid monolayer decreases the specific resistance by twenty fold.

In the liquid condensed phase on pure water, specific resistance is independent of surface pressure in the range from 10 to 25 dynes/cm, and its logarithm is a linear function of the number of carbon atoms comprising the monolayer molecules. For nonadecanoic acid films, the resistance on dilute hydrochloric acid solutions at pH 1 and pH 3 is the same as on pure water at pH 5.8.

For solid phase films on a subphase containing calcium ions at pH 8, resistance to evaporation for a given acid is greater than in the liquid condensed phase, and the logarithm of resistance is a linear function of both chain length and surface pressure.

In the temperature range from 15°C to 30°C, the logarithm of the resistance of nonadecanoic acid on pure water is a linear function of the reciprocal of the absolute temperature.

Specific resistance is described by a relation of the form

$$r = \text{constant} \times \exp(E/RT)$$

where E is the energy barrier to condensation. The films are assumed to have a close packed hexagonal structure over short ranges. It is postulated that in order for a water molecule to evaporate or condense, a free site must be formed in the array and that the energy barrier to condensation is the increase in the potential energy of the film when a free site is formed. This energy change is just the interaction energy of a molecule in the film with all of its neighbors and with the water surface. Its magnitude can be estimated from the heats of vaporization of the fatty acids. Values from this source agree well with the experimental values.

The condensation coefficient for the films studied is given by

$$\alpha = 8.56 \times 10^5 \exp(-E/RT)$$

and specific resistance by

$$r = 7.89 \times 10^{-11} \exp(E/RT)$$

where, for the liquid condensed phase on pure water or hydrochloric acid solutions,

$$E = 9,556 + 296.6(n-2) \text{ cal/mole}$$

and, for the solid phase on  $10^{-4}$  M  $\text{CaCl}_2$  and  $10^{-3}$  M  $\text{KHCO}_3$ ,

$$E = 11,517 + 191.0(n-2) + 9.00p \text{ cal/mole.}$$

n is the number of carbon atoms in the molecule and p is the surface pressure.

For all of the monolayers studied, the presence of the film decreases the evaporation rate by a factor of about  $10^{-4}$  68 pages. \$1.50. Mic 56-3230

**A MINIMUM-PRINCIPLE FOR  
NON-EQUILIBRIUM STATIONARY STATES**  
(Publication No. 19,231)

Thor Anders Bak, Ph.D.  
Columbia University, 1956

In this work it was attempted to find a way of characterizing non-equilibrium stationary states by an extremum principle formally analogous to the principle we use when we characterize equilibrium as a state of maximum entropy. It has been shown by Prigogine that when the stationary state is close to equilibrium the state is characterized by a minimum in entropy production. The present work is a generalization of Prigogine's theorem.

The generalization has been made by constructing a function which will have minimum for any stationary state and furthermore near equilibrium will reduce to the entropy-production. This function has the form of a sum of resistances times fluxes squared.

The important step is to find the right form of the quantities we have called resistances. This is studied in a number of cases, such as chemical reactions, ordinary diffusion and diffusion in an external field. Although the results are only established for these special cases, they are believed to be of general nature.

It is shown that from this minimum-principle one can prove that Le Chatelier's principle is valid for any time-independent state of the systems discussed. Finally the principle is used to discuss fluctuations around stationary states. Here only the very simple example of Ehrenfest's urn model is discussed, and the results cannot be considered more than conjectures.

It is believed that the use of this generalized entropy-production in the study of chemical kinetics and diffusion is new and that it may prove fruitful, because it allows us to study similarities and differences between irreversible processes near equilibrium and far from equilibrium.

60 pages. \$1.50. Mic 56-3231

**STUDIES IN ANALYTICAL CHEMISTRY**

(Publication No. 17,294)

Frederick Baumann, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Associate Professor Walter J. Blaedel  
and Assistant Professor Irving Shain

**Part I. Application of High Frequency Methods to Detection of Bands in Partition Chromatography.**

The high frequency method may be used to monitor partition chromatographic columns if conductance changes occur during elution. The advantage of the high frequency

method over the low frequency method is that external electrodes may be employed. In this study a 4 megacycles/second tuned-grid tuned-plate oscillator was used to follow the separation of carboxylic acids. Changes in grid voltage occurring during the elution of the acids were measured. An automatically recorded chromatogram is shown. The shape of the peaks is roughly correlated with the nonlinear response of the instrument and with such factors as the total concentration of the acids in the band, distribution of the acids between the aqueous and chloroform phases, dissociation constants of the acids, and the band width.

**Part II. The Reduction of Chromium(VI) at Rotating Gold Microelectrodes.**

The reduction of chromium(VI) in acid media was studied with rotating solid microelectrodes. Particular emphasis was placed on the application of gold electrodes to this problem. Since the characteristics of gold electrodes have not been determined previously, a critical study of their behavior was made.

Residual current curves obtained with gold microelectrodes were interpreted. Typical residual current curves obtained in perchloric and hydrochloric acid media are shown.

The effects of oxide films and surface contamination on current-voltage curves with gold electrodes were determined. A method of electrode pretreatment was developed which leads to consistent results.

The analytical applications of gold electrodes were determined for the reduction of chromium(VI). Gold electrodes were found to be suitable for the direct determination of chromium(VI) and superior to platinum electrodes for the indirect determination of chromium(VI).

Platinum electrodes were found to be unsuited for studying the reduction of chromium(VI) in acid media since chromium(VI) oxidizes platinum forming an oxide film on the surface of the electrode which lowers the rate of the electrode reaction. Gold electrodes are suitable since gold is less susceptible to oxidation.

A theoretical treatment for irreversible current-voltage curves at rotating solid microelectrodes was derived. Application of this treatment to the kinetic study of the reduction of chromium(VI) in perchloric acid media results in a rate equation of the form,

$$\frac{d [\text{Cr(VI)}]}{dt} = \frac{kK_c [\text{Cr(VI)}] [H^+]^2}{[H^+] + K_c}.$$

Considering the rate determining step to involve two electrons, the activated complex has the composition  $H_3\text{CrO}_4^-$  since the predominant chromium(VI) species in the concentration ranges studied is  $\text{HCrO}_4^-$ . A mechanism consistent with the experimental results and the above consideration is postulated. 90 pages. \$1.50. Mic 56-3232

**APPARATUS FOR CALORIMETRY OF AQUEOUS SOLUTIONS OF ELECTROLYTES AT HIGH TEMPERATURES AND HIGH PRESSURES**

(Publication No. 17,944)

John Manuel Christens, Ph.D.  
Indiana University, 1956

An apparatus consisting of twin high-pressure calorimeters has been constructed for the study of the heat capacities of aqueous solutions of electrolytes up to the critical point of water.

The calorimeters are made out of special steel to withstand 3,300 psi at 375°C. They have inner liners of platinum-clad nickel to resist corrosion and a 1/16" outer silver plating to insure temperature uniformity. Their platinum-lined outlet tubes are connected to a pressure system including a deadweight gauge and glass capillary solution level gauges.

Both calorimeters are supported from the lid of a heavy copper adiabatic jacket and surrounded by silver radiation shields. The adiabatic jacket, in turn, is surrounded by two polished aluminum radiation shields and enclosed in a steel jacket in which a vacuum of 0.06 micron can be obtained and 0.2 micron can be easily maintained.

The vacuum system includes a diffusion pump, a series of glass-to-metal seals for electrical leads, double "O"-ring seals, a series of troughs filled with Woods metal, and a McLeod gauge. The temperature is measured by a platinum thermometer, and temperature differences by a series of differential thermels (chromel-constantan for maximum sensitivity).

A safety system was designed to give protection against excess pressure, explosion, or failure of the vacuum, power, cooling water flow, or mechanical support.

Two internal seven-branch-star heaters and a selector switch, both of new types, were designed for the quantitative heating of the calorimeters. They provide a great number (50,000 or more) of slightly different resistances ratios permitting the matching of the ratio of the heat capacities of the twin calorimeters (one filled with water and the other with solution) within very small limits and with very small final temperature differences. Great difficulty was encountered in bending their platinum casings in the desired helicoidal shape.

Diphenyl ether of high purity, with a mole fraction of impurity of 0.00072, was prepared for use as a secondary heat capacity standard.

Detailed information is given about the practical problems encountered: i.e., design of bombs, grinding of leak-proof platinum seats, etc., together with suggestions to remedy present defects of the apparatus: i.e., better cooling water flow control and sturdier construction of the heaters and thermels. Because of the high temperature, the only insulating materials used are woven glass, "Micamat," and "Mycalex" and their mechanical properties are not altogether satisfactory.

A brief theoretical survey is also given together with some calculations relative to the calibration of the calorimeters, the number of radiation shields, and different thermodynamic measurements possible with this apparatus. Recommendations are also included concerning the design of calorimeters suitable for intermediate temperatures and pressures and the possibility of introducing automatic recording and controlling equipment in the present apparatus.

The results of preliminary measurements show a very low rate of heat leakage to the atmosphere ( $k = 3 \text{ cal/deg-min}$ ), the need for very precise heater control, and the great importance of the heat leakages along the calorimeter outlet tubes.

Detailed wiring diagrams, mechanical blueprints, and sketches of proposals are given together with assembling, disassembling, and operating instructions.

208 pages. \$2.70. Mic 56-3233

**PERMEABILITY AND ABSORPTIVITY OF INDIANA LIMESTONE COARSE AGGREGATES**

(Publication No. 18,884)

William Lee Dolch, Ph.D.  
Purdue University, 1956

Major Professor: M. G. Mellon

Many studies have shown the importance of the coarse aggregate component in the determination of the resistance to freezing and thawing as a durability factor in the performance of pavement concrete. Field and laboratory studies have been used in Indiana to identify certain limestone coarse aggregates as outstandingly good or poor with respect to the resistance to frost action of the concrete made with them. Data from standard tests of aggregates are only partially successful in the prediction of the field performance of pavements. Information is inadequate concerning the mechanisms by which these materials exert such great influence.

Since the presence of water is fundamental to frost damage, the details of the acquisition and retention of water by these materials and of its movement therein become important. The pore structure has been shown to be one of the most important properties of coarse aggregates when they are used in portland-cement concrete. The nature of this structure is not completely evaluated by tests now being performed on these materials. More information is needed concerning this property.

This study was designed to investigate the usefulness of simple fluid-flow measurements and of the data derived therefrom with respect to the elucidation of the pore structure of limestone coarse aggregates and to a possible correlation with the durability histories of pavements made with limestone aggregates.

Five limestones with well-established durability histories were chosen. The quarries were sampled. Small prisms were cut from the larger samples and were finished by hand grinding. Their dimensions were measured. The specific surfaces were determined on pulverized samples by the use of water-vapor sorption with a gravimetric technique and the Brunauer, Emmett, Teller theory. Values of the absorption for both the immersed and the vacuum-saturated conditions were determined by conventional methods on the prisms. Porosities and true and bulk densities were determined using a gas-compression volumenometer and a McLeod gage porosimeter. Permeabilities were determined at various mean pressures with a pressure-decay permeameter and an equation derived for this apparatus. The Klinkenberg slip factors and the pressure-independent permeabilities were determined from the plots of the permeability data. Tortuosities of

the rocks were measured by the electrical-analog resistivity method. Absorptivities were determined with a simple gravimetric technique.

The specific surfaces and average pore radii were calculated from these data on the basis of a tortuous capillary-tube model. These calculations were made using the Koseny equation for the permeabilities, a modified Klinkenberg equation for the slip factors, and a derived equation for the absorptivities.

The absorptivity method was found to be superior to the permeability or slip methods as an interpreter of specific surface. An empirical relation was shown by means of which a fairly-good value of the permeability could be derived from the easily-measured absorptivity value.

The tortuosities, slip factors, and average pore radii had no relation to the durability histories of the materials. The poor-quality materials had higher porosities, permeabilities, specific surfaces, and absorptivities than did the good-quality materials. The differences were especially noticeable in the case of the absorptivity values. The materials could also be separated according to their durability histories on a basis of the rate of capillary saturation which was calculated from the absorptivities and the porosities and on a basis of the ratio of absorptivity to permeability; the poor-quality materials in every case had higher rates of saturation and higher absorptivity to permeability ratios.

The usefulness of the methods and principles involved and the desirability of their further application to evaluating the quality of coarse aggregates for use in portland-cement concrete are indicated.

171 pages. \$2.25. Mic 56-3234

#### THE DIELECTRIC PROPERTIES OF AEROSOLS

(Publication No. 17,948)

Paul Brendel Dorain, Ph.D.  
Indiana University, 1954

Existing theories show that the difference in dielectric constant between an aerosol and that of the supporting medium, hereafter called the dielectric increment,  $\Delta k$ , is given by the equation

$$\Delta k = k_m - k_2 = 3k_2 \left( \frac{k_1 - k_2}{k_1 + 2k_2} \right) \frac{c}{\rho} \times 10^{-9} = Ac = 10^{-9} \quad (1)$$

where  $k_m$  is the dielectric constant of the aerosol;  $k_2$ , the dielectric constant of the dispersing medium;  $k_1$ , the dielectric of the aerosol material;  $c$ , the mass concentration of the particles in micrograms per liter; and  $\rho$  is the bulk density of the aerosol material.

A Birnbaum microwave refractometer was constructed and used to measure at 9385 Mc/s. the dielectric increment of dioctyl phthalate and triethylene glycol di(2-ethyl butyrate) aerosols over a range of concentrations from 20 to 750 micrograms per liter. For dioctyl phthalate aerosols, the theoretical value of  $A$  is 1.03, and the experimental slope has a value of 0.944 with a standard deviation of 0.032. The theoretical value of  $A$  for triethylene glycol di(2-ethyl butyrate) aerosols is 1.21 and the experimental value is 1.137 with a standard deviation of 0.030.

The measurements show that the theories are correct

within the experimental error. The results also indicate that measurements of the dielectric increment may be used to estimate mass concentration independently of particle size at concentrations greater than twenty micrograms per liter. A discussion of the operation of the Birnbaum refractometer is included in the thesis.

61 pages. \$1.50. Mic 56-3235

#### AN INVESTIGATION OF SOME NITRIDES AND LOWER OXIDES OF SAMARIUM, EUROPIUM, AND YTTERBIUM

(Publication No. 17,470)

Harry Arthur Eick, Ph.D.  
State University of Iowa, 1956

Chairman: Associate Professor LeRoy Eyring

Samarium, europium, and ytterbium nitrides were prepared by the direct combination of the metal with nitrogen. All were of the NaCl-type structure. The lattice parameters as determined with Cu  $K\alpha$  radiation ( $K\alpha_1 = 1.54051 \times 10^{-8}$  cm.) were  $5.0481 \pm 0.0004 \text{ \AA}^0$  for SmN,  $5.007 \pm 0.002 \text{ \AA}^0$  for EuN, and  $4.7852 \pm 0.0004 \text{ \AA}^0$  for YbN. Their calculated densities were  $8.5 \text{ g/cm}^3$ ,  $8.8 \text{ g/cm}^3$ , and  $11.3 \text{ g/cm}^3$ , respectively.

Two additional NaCl-type structures believed to be SmO and EuO were observed. The lattice parameters of what was believed to be the purest preparations of the compounds as determined by X-ray powder diffraction were  $4.9883 \pm 0.0003 \text{ \AA}^0$  and  $5.1439 \pm 0.0005 \text{ \AA}^0$ , respectively. The variation in lattice parameter previously reported of  $5.015$  to  $5.050 \text{ \AA}^0$  for SmO was explained as that of a mixed nitride-oxide combination, with the upper value being that of the pure nitride, SmN.

A low oxide of samarium whose O/Sm ratio varies from 0.4 to 0.6 was prepared by distillation of samarium and  $\text{Sm}_2\text{O}_3$  in argon. The compound had a zincblende-type structure with a lattice parameter which varied from  $5.3698 \pm 0.0003 \text{ \AA}^0$  to  $5.3790 \pm 0.0008 \text{ \AA}^0$ . This oxide decomposed into a different phase believed to be a still lower oxide when distilled in high vacuum.

A stable compound, SmO(OH) was observed in the thermal decomposition of the hydrolysis product of SmN.

121 pages. \$1.65. Mic 56-3236

PART I: THE SECOND AND THIRD ORDER INTERACTION OF GAS MOLECULES AND A SURFACE  
 PART II: SOLID SOLUTIONS OF KRYPTON IN XENON AND THE VAPOR PRESSURE OF ARGON, KRYPTON, AND XENON

(Publication No. 17,124)

Mark Phillips Freeman, Ph.D.  
 University of Washington, 1956

PART I

Interaction of a gas and a solid surface at temperatures high above the range in which adsorption measurements are usually carried out is treated quite rigorously. Using a modified version of the imperfect gas formalism, expressions relating the "measureables," pressure, volume and temperature, are defined in terms of certain parameters and are rigorous for interactions involving up to two gas molecules, like or unlike, and the surface.

The second and third order interaction are shown to be easily experimentally separable. Defining the "apparent volume,"  $V$ , as the measured volume of the vessel assuming the ideal gas law, the second order interaction contributes a temperaturewise dependence of  $V$  extrapolated to zero pressure and the third order interaction contributes a pressurewise dependence of  $V$ .

Experiments are described in which gases and mixtures of gases were allowed to interact with several solids. It is observed that those aspects of the theory which permit experimental confirmation independent of any assumed molecular model are verified within experimental error.

A crude model for intermolecular forces is then proposed and the parameters mentioned above are theoretically evaluated without arbitrariness. The agreement with those found experimentally is surprisingly good.

This work constitutes an extension of the earlier work of Steele and Halsey who treated the second order interaction through use of the Boltzmann formula.

PART II

An attempt is made to put contemporary solution theory to a test by studying a solution that satisfies all the requirements of the quasi-chemical treatment of strictly regular solution theory. This particular theory was chosen for the study because it is more tractable than the other leading theories and it has been shown by Scott that all of these theories are equivalent in the first approximation.

The derivation of strictly regular solution theory given by Fowler and Guggenheim is reexamined and it is found possible to alter it so that no restrictions on the temperature dependence of the heat-of-solution parameter,  $w$ , are necessary. A new solution theory of Prigogine and Belleman is briefly discussed in which a temperature dependence for  $w$  is predicted.

Solid solutions of krypton and xenon were studied by a new method. The solution behavior was followed through measurement of the total pressure and the analysis of the gas and solid were done mathematically. In the range of temperatures examined (from 87.2°K to 120.2°K) the substances were found to be miscible in all proportions except at the lowest temperature where phase splitting was observed to occur.

It is shown that a temperature independent  $w$  is not adequate for even this simple solution but that the quasi-chemical treatment of strictly regular solution fits the data within experimental error. At the same time, of course, it fails to predict any temperature dependence of  $w$  and so would not in general be useful for predicting, say, critical solution temperature. The magnitude of  $w$  and its temperature dependence are found to be in fairly good agreement with those predicted by Prigogine and Belleman. It is suggested by the author that some modification of the latter theory could be used in conjunction with the former to form a "canonical" solution theory. Solutions could then be described by their deviation from this "canonical" theory.

The vapor pressures of solid and liquid argon, krypton and xenon are given as well as the boiling and triple points of these substances. 151 pages. \$2.00. Mic 56-3237

SILVER FISSION INDUCED BY 388 MEV. PROTONS

(Publication No. 19,263)

Daniel Harry Greenberg, Ph.D.  
 Columbia University, 1954

The production of light nuclei by bombardment of medium weight elements with high energy particles (100-400 Mev.), has been reported in the literature. It has been suggested that such products are produced by the fission of the target nucleus.

While many isolated products have been noted, no thorough investigation of these "fission" products has been undertaken. For this reason the following study was initiated.

High purity silver foil was irradiated with the 388 Mev. protons of the circulating beam of the Nevis Cyclotron. Fractions corresponding to the elements scandium through gallium were chemically separated, and radionuclides were identified by counting with a geiger tube. In total, the yields of 28 isotopes, varying in mass from  $A = 43 - 73$ , were obtained.

The distribution of these products is consistent with a process that is evaporation controlled, and the conclusion is drawn that the primary fission products must have been highly excited. No preferred mode of fission was observed.

88 pages. \$1.50. Mic 56-3238

THE SOLUBILITY OF SLIGHTLY SOLUBLE COBALTAMMINES IN MIXED SOLVENTS

(Publication No. 18,793)

Robert Murphy Hall, Ph.D.  
 The Ohio State University, 1956

The object of the investigation was to determine the changes in solubility of some strong electrolytes with changes in the dielectric constant of the solvent, and to compare the results with present theory.

The solubilities of the 1:1 salts flavo and croceo (*cis*

and trans dinitrotetrammine cobalt-III) tetranitrodiammine cobaltate were determined over the entire composition range of water-dioxane mixtures at  $25.00 \pm .02^\circ$  C. The solubility of potassium tetranitrodiammine cobaltate was determined over the entire composition range of metacresoldioxane mixtures at  $25.00 \pm .02^\circ$  C. The solubility equilibria were established both from undersaturation and oversaturation, and the concentrations of the saturated solutions were determined by using cobalt-60 as a radio-tracer in the anion.

None of the three salts studied exhibits behavior in agreement with existing theory, which predicts a continuous decrease in solubility with decreasing dielectric constant.

The flavo tetranitrodiammine cobaltate solubility is  $5.23 \times 10^{-3}$  moles per liter in pure water; it decreases to a minimum value of  $2.44 \times 10^{-3}$  moles per liter at 18 weight per cent dioxane, rises slowly to a maximum value of  $2.86 \times 10^{-3}$  moles per liter at 42 weight per cent dioxane, then decreases to  $2 \times 10^{-6}$  moles per liter in pure dioxane.

The croceo tetranitrodiammine cobaltate solubility rises from  $6.43 \times 10^{-4}$  moles per liter in water to a maximum of  $1.31 \times 10^{-3}$  moles per liter at 46 weight per cent dioxane, then decreases to  $3 \times 10^{-7}$  moles per liter in dioxane.

The solubility of the potassium tetranitrodiammine cobaltate decreases from  $8.3 \times 10^{-6}$  moles per liter in m-cresol to a minimum of  $2.8 \times 10^{-6}$  moles per liter at 23 weight per cent dioxane, then increases until in pure dioxane the solubility ( $8.0 \times 10^{-6}$  moles per liter) is only slightly less than that in m-cresol.

Calculations were made to show that the anomalous results found for the flavo and croceo salts are not attributable to salt effects or to changes in the mean ionic radius.

The possibility of complex formation in solution was examined. Cobalt analyses of the equilibrium solids from three solubility experiments indicated compound formation between the undissolved flavo salt and dioxane, in the ratio one to one, over most of the solvent composition range. Absorption spectra of solutions of the salts did not give positive evidence of complex formation.

Calculations were made showing that the effect of preferential sorting of solvent molecules does not lead to the observed behavior. The solvent-sorting correction was also calculated for three waterethanol mixtures and applied to data from other sources.

The logarithms of the solubilities of the flavo and croceo salts are linear functions of the reciprocal of the dielectric constant at low dielectric constants. Although this behavior is predicted by the Born expression for the activity coefficient, the ionic radii required to give the observed slopes are so large as to cast doubt upon the applicability of the theory.

Calculations on the possibility of ion association for potassium tetranitrodiammine cobaltate showed that, at the solubilities observed, association is almost complete on the low dielectric constant side of the minimum in the solubility curve.

124 pages. \$1.65. Mic 56-3239

#### THE KINETIC ENERGY OF LOCALIZED ELECTRONS

(Publication No. 19,245)

Jerome David Herniter, Ph.D.  
Columbia University, 1956

The energy of a molecule can be determined from the equation  $E = \zeta \psi^* H \psi \Delta T / \zeta \psi^* \psi \Delta T$  by a variation procedure.  $H$  is the hamiltonian of the molecule,  $E$  the energy and  $\psi$  an approximate wave function. The approximate wave function we have chosen is an antisymmetrized product, composed of non-overlapping single electron orbitals. The orbitals are considered to be completely general. The best orbitals are those which yield the minimum energy of the molecule.

Due to the non-overlapping condition placed on the orbitals the only integrals which appear in the energy equation are the kinetic energy and potential energy integrals. Since the orbitals are completely general, it is necessary to approximate these integrals. The potential energy integrals are approximated by the potential energy due to the interactions between uniformly charged spheres and between uniformly charged spheres and point charges. The kinetic energy integrals are approximated by the minimum kinetic energy due to an electron confined within a region of space.

This method was used to calculate the dissociation energy and the bond distance of methane. The results are compared with those obtained from a molecular orbital calculation and a valence bond calculation.

72 pages. \$1.50. Mic 56-3240

#### CONVECTIVE-DIFFUSION CURRENT AT A DROPPING MERCURY ELECTRODE AT SHORT DROP TIMES

(Publication No. 18,803)

Lawrence Franklin Koons, Ph.D.  
The Ohio State University, 1956

The convective-diffusion current at a dropping mercury electrode has been investigated in the drop time range, one second to one-fiftieth of a second. By means of a semi-theoretical method, an expression has been found which relates the current to the drop time, the rate of flow of mercury, the radius of the capillary, and the diffusion coefficient and concentration of the reacting species. A generalized expression is assumed for the tangential velocity on the surface of the drop, and the corresponding Smoluchowski equation is solved, subject to certain assumptions. By a method of iteration, the assumed form of the velocity function is adjusted so that the resultant solution accounts for the experimental data. The expression for the velocity function thus obtained contains a parameter which must be experimentally determined. There is some theoretical evidence, in justification of this velocity function, which indicates that this parameter depends upon the viscosity of mercury and the interfacial tension of the mercury-electrolyte system.

98 pages. \$1.50. Mic 56-3241

**FORMATION OF MOLECULAR COMPLEXES  
BETWEEN WATER-SOLUBLE AMIDES AND  
SOME PHARMACEUTICAL COMPOUNDS**

(Publication No. 17,320)

Harry Barr Kostenbauder, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Takeru Higuchi

Compounds such as N, N-dialkylamides are capable of acting as electron donors and would theoretically be expected to form molecular complexes in aqueous solution with certain organic compounds which act as proton donors. Definite evidence was obtained for the formation of both soluble and insoluble molecular complexes as a result of interactions in aqueous solution between N,N-dialkylamides and several proton donors such as p-hydroxybenzoic acid, salicylic acid, chloramphenicol, and phenol.

Phase diagrams were obtained by determining the influence of several amides on the water solubility of p-hydroxybenzoic acid, salicylic acid, and chloramphenicol. In many cases it was possible to isolate and analyze a solid complex resulting from these interactions. The interaction of phenol with the amides was observed by studying the distribution of phenol between an organic phase and aqueous solutions of the amides.

The following compounds were shown to form relatively stable molecular complexes in aqueous solution with proton donors such as p-hydroxybenzoic acid, salicylic acid, chloramphenicol, and phenol.

N,N,N',N'-Tetramethylphthalamide  
N,N,N',N'-Tetramethylisophthalamide  
N,N,N',N'-Tetramethylterephthalamide  
N,N,N',N'-Tetramethylfumaramide  
N,N,N',N'-Tetramethylsuccinamide  
N,N,N',N'-Tetraethylisophthalamide  
N,N,N',N'-Tetraethylterephthalamide  
N,N,N',N'-Tetraethylfumaramide

Amides which did not appear to undergo complex formation with the previously mentioned proton donors to any appreciable extent in aqueous solution were polyacrylamide and poly-N,N-dimethylacrylamide. At high phenol concentrations, however, there was a relatively insoluble complex produced by the interaction of phenol and poly-N, N-dimethylacrylamide in aqueous solution.

A comparison of the complexing tendencies of the amides of dimethylamine and those of diethylamine indicated that the formation of molecular complexes in aqueous solution can be enhanced by the "squeezing-out" effect of water on complexing agents rendered less water soluble by structural modifications. Experimental evidence indicated, however, that stereochemical effects may impose limitations on these modifications. These limitations may be a function not only of the nature of the amide itself, but also of the compound with which it is interacting.

The results of these studies on the complexing ability of N,N-dialkylamides indicate that these compounds may have important industrial or pharmaceutical applications as solubilizers or stabilizers. More important, perhaps, is the indication that the formation of molecular complexes in aqueous solution is not confined to a few compounds such as the xanthines, polyethylene glycols, or polyvinylpyrrolidone, but may be a relatively common occurrence

among many types of organic compounds in aqueous solution.  
123 pages. \$1.65. Mic 56-3242

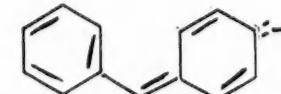
**ELECTRONIC SPECTRA OF MONOMERS  
AND DIMERS OF PYRIDOCYANINE DYES,  
WITH ASSIGNMENTS OF TRANSITIONS**

(Publication No. 18,501)

Gerald Stanley Levinson, Ph.D.  
University of Washington, 1956

The dye, 1,1'-diethyl-2,2'-pyridocyanine iodide is found present as the undissociated monomer and dimer in rigid solutions at liquid-nitrogen temperature. In the visible region, one absorption band is observed for the monomer while two are observed for the dimer. One of the dimer bands occurs at shorter wavelengths than that of the monomer while the other is at longer wavelengths. The monomer and dimer each have different emission spectra, too. The study of the polarization of emission from these solutions suggests that the two dimer transitions are perpendicular. Quantum theory, as applied to two weakly interacting systems is shown to give the properties observed for the dimer.

The spectra of several pyridocyanine dyes are compared, and it is concluded that the positions of the nitrogen atoms are not very important to the spectra, and the gross features of the spectra of all pyridocyanine dyes are believed to be quite similar to those of the hypothetical carbosocyclic dye,



For this dye the symmetries of the first three electronic states are assigned to be A<sub>1</sub>, B<sub>2</sub>, and A<sub>1</sub>, respectively, in the notation of the C<sub>2v</sub> symmetry group. The spectra of 2,2'-pyridocyanine dyes indicate a strong tendency for these dyes to assume an unsymmetric configuration. The electronic states of polymethine dyes are considered by the molecular orbital method, a valence bond model, and in terms of the two-structure representation.

108 pages. \$1.50. Mic 56-3243

**STUDIES ON THE POLYMERIC  
NATURE OF LIGNINS**

(Publication No. 18,505)

Jovan Moacanin, Ph.D.  
University of Washington, 1956

Wood consists of about forty percent of cellulose, twenty percent of hemicelluloses and twenty percent of a material called lignin. The chemical structure of lignin is not yet elucidated but it appears to be a polymeric material built from phenylpropane-type structural units. To further knowledge of the organization of the lignin polymers, procedures have been developed by which molecular weight and molecular weight distributions of polymers

may be estimated, these procedures have been used in a study of certain lignin sulfonate preparations.

Western hemlock wood has been treated with a sodium bisulfitesulfurous acid solution to obtain the lignin sulfonates in aqueous solution. This solution was exhaustively dialyzed and the non-dialyzable lignin sulfonates were recovered and separated into ten fractions by a reprecipitation method. The lignin sulfonate fractions were characterized by ultraviolet absorption spectra and absorptivities, and by diffusion coefficients. Light scattering measurements were carried out on some of the lignin sulfonates and from the turbidity values found, weight average molecular weights were estimated. The relationships found to exist between the molecular weights and the diffusion coefficients are explained by considering that lignin molecules exist in solution as non-rigid chains.

A procedure has been evolved by which the distribution of diffusion coefficients within polymer preparations may be estimated. To estimate the distribution of diffusion coefficients, diffusion is permitted to occur from a solution into a gel phase and, after a suitable period, the concentration of the polymeric material is measured at various distances from the boundary using a method already described in a paper published from this Laboratory. These observations are normalized and then fitted with a polynomial by use of the method of least squares. This polynomial is used to extrapolate the data to the phase boundary and a probability function is used to extrapolate the data to distances beyond those for which experimental data are available. Integrations of appropriate equations involving these data are conducted to yield the first four statistical moments of the distribution of diffusion coefficients. From these four moments, the cumulative weight distribution of diffusion coefficients is then computed. Experimental trials with lignin sulfonate preparations have shown that this procedure may be used to estimate the distribution of diffusion coefficients in polymer preparations.

However, it is the distribution with respect to the molecular weights that is usually of more interest than that of the diffusion coefficients. Therefore, to provide a basis for translating distributions of diffusion coefficients in lignin sulfonate preparations into distributions of molecular weights, the diffusion coefficients and the molecular weights of certain lignin sulfonates were correlated. This correlation was used together with the data from diffusion experiments to estimate the molecular weight distributions in the ten lignin sulfonate fractions described above, and these distributions were then summed to estimate the molecular weight distribution of the original lignin sulfonate preparation. It appears that this procedure for estimating distributions of molecular weight gives results more nearly correct than the conventional one where the polydispersity in the fractions is not considered.

A preliminary study was made and the findings are given of the change in distribution of molecular weights of lignin sulfonates which occurs as a result of heating in aqueous acidic conditions.

128 pages. \$1.70. Mic 56-3244

#### X-RAY DIFFRACTION STUDIES OF AQUEOUS BARIUM IODIDE SOLUTIONS

(Publication No. 17,338)

Allen Kelsey Prince, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Paul Bender

The radial distribution function for aqueous solutions of barium iodide of 2.98 and 1.05 Formal concentration were determined from x-ray diffraction studies by the method of Warren, Krutter and Morningstar. The general consistency of the results under the interpretation applied are considered to show the applicability of the method to systems of this type. A freely flowing stream of solution was irradiated with crystal-monochromated  $K_{\alpha}$  radiation from a molybdenum target x-ray tube, and the intensity distribution recorded photographically in a camera of conventional design. The Fourier integral of the radial distribution equation was evaluated by means of the trapezoidal rule, utilizing for the calculation an I.B.M. Type 650 magnetic drum calculating machine. Details of the program used in the calculation are presented.

It was observed that the experimental intensity distributions for these solutions reduced to the calculated independent intensity distributions at relatively low scattering angles, the normalization of the experimental intensity curve to electron units being accomplished at values of  $s$  of the order of 7.5. The radial distribution function for the 2.98 Formal solution was found to possess a well-defined maximum at  $3.78 \text{ \AA}^0$ , a broad maximum in the  $r$  range 5.3 to  $6.2 \text{ \AA}^0$ , and a faint maximum at  $7.5 \text{ \AA}^0$ . The prominent maximum at  $3.78 \text{ \AA}^0$  was interpreted as reflecting the distance between associated barium and iodide ions in the solution. The area under this peak yielded an estimate of four to six for the coordination number of iodide ions about a barium ion in the solution, and the broad peak on the radial distribution curve at  $5.7 \text{ \AA}^0$  was associated with the distance between iodide ions coordinated to the same barium ion. The faint maximum at  $7.5 \text{ \AA}^0$  suggested that the octahedral arrangement of the iodide ions about a barium ion in the crystalline hexahydrate is present to some extent in the solution.

A maximum at  $3.95 \text{ \AA}^0$  and a faint maximum at  $5.75 \text{ \AA}^0$  on the radial distribution curve for the 1.05 Formal solution were considered to show the persistence of ion association at this higher dilution. The appearance and position of these peaks reflected the expected decrease in the ordering of structure and average  $I^-$  to  $Ba^{++}$  coordination number.

Maxima at  $3.02 \text{ \AA}^0$  and  $4.9 \text{ \AA}^0$  in the curve for the more dilute solution, corresponding to maxima present in the radial distribution function for liquid water at higher temperatures, were taken to indicate the presence of the expanded liquid water lattice commonly assumed to exist in ionic solutions. Faint indications of these maxima were found in the curve for the concentrated solution. The absence of any maximum which could be assigned to the hydration radius of the barium ion is reasonable, since this distance would be expected to be nearly the same as the nearest neighbor distance in liquid water.

110 pages. \$1.50. Mic 56-3245

**A STUDY OF THE CATALYTIC HYDROGENATION  
OF METHOXYBENZENES OVER PLATINUM  
AND RHODIUM CATALYSTS**

(Publication No. 19,293)

Robert Gene Thompson, Ph.D.  
The University of Tennessee, 1956

Major Professor: Hilton A. Smith

The catalytic hydrogenation of the following methoxy compounds has been studied: anisole, *o*-, *m*-, and *p*-dimethoxybenzene; *o*-, *m*-, and *p*-methoxytoluene; *o*-, *m*-, and *p*-methoxybenzoic acid; and 1,2,3-trimethoxybenzene. Hydrogenation of the aromatic ring was usually accompanied by some cleavage of the methoxyl groups. This cleavage occurred predominately upon the carbon-oxygen bond adjacent to the aromatic ring. The cleavage reaction was found to occur only as a part of the aromatic hydrogenation process. The amount of cleavage was found to be dependent upon the catalyst used. Platinum led to extensive methoxyl cleavage while rhodium catalyzed ring saturation with little cleavage. Also found to influence the extent of cleavage were reaction temperature and acid concentration.

A mechanism for the cleavage has been proposed. This mechanism involves the formation of a methoxycyclohexene or equivalent in which the carbon-oxygen bond of the ether is labilized by the  $\beta$  -  $\gamma$  carbon-carbon double bond.

The utility of various rhodium compounds as catalysts for the hydrogenation of the benzene nucleus has been demonstrated. With respect to catalytic activity, supported catalysts have been shown to be superior to the pure metals when the two groups are compared on the basis of percentage of active constituent.

The effect of substitution and number of substituents on the rate of hydrogenation was found to be about the same for the various methoxybenzenes as for the corresponding methyl compounds. 104 pages. \$1.50. Mic 56-3246

at 5° and 25°C. The more dilute solutions were studied at 25°C in horizontal capillary viscosimeters which permitted measurement at very low shear stresses. In addition, data were taken on two solutions at the Mellon Institute in a cone-and-plate viscosimeter.

The apparent activation energy for flow was linear in concentration and extrapolated into the value for the aqueous solvent. The concentration dependence of the zero-shear viscosity showed that, while salt lowered the viscosity at a lower concentration, it had no effect at a higher concentration. This may be attributed to the increased ionic strength of the SDNA itself. Relative viscosities of the solutions in 50.4% glycerol were considerably lower than those of the corresponding aqueous solutions.

To correlate experimental shear dependence of flow with theory, the measured capillary results were converted to their values at a homogeneous shear rate. Comparison with theory showed that, at higher concentrations, flow was accompanied by configurational change indicating flexibility of the molecules. At lower concentrations flow resembled that of solutions of rigid ellipsoids reflecting the inherent stiffness of the molecules. The shear dependence in glycerol indicated that the solvent caused a change in the shape of the SDNA molecule, probably a denaturation.

Dynamic measurements were made in the wave propagation apparatus at 5°, 15°, 25°, and 35°C and at frequencies from 20 to 400 cps. Data were taken in a torsional apparatus at the Mellon Institute on two solutions at 25°C at frequencies from 0.0006 to 0.6 cps. The data were successfully reduced to unit temperature, viscosity, and concentration by reduced variables. The presence of salt at a high SDNA concentration had no effect on the dynamic properties or their reduction.

A relaxation distribution function was calculated which contained the three areas characteristic of linear polymers, a transition region, plateau, and terminal zone. The similarity of the shape of the distribution to those for coiling polymers indicated that, as in steady flow, the relaxation processes in the more concentrated solutions are due to configurational changes.

The terminal zone of the distribution could be predicted by theory, as has been found for other polymers. The plateau occurred at a lower concentration and at a lower level than has been observed previously. These characteristics are discussed in terms of molecular entanglements.

In addition to the work done with SDNA, some preliminary viscosity and dynamic measurements were made on two solutions of polymerized fibrinogen. The inhibited polymer was formed at pH 9.5 in the presence of 0.5 M hexamethylene glycol. The non-Newtonian flow, compared with theories for rods and ellipsoids, indicated that the molecules were rigid and elongated. The dynamic measurements gave the first experimental demonstration of the theoretical prediction of an elastic component in solutions of rod-like molecules. The molecular lengths, calculated from both kinds of measurements, agreed in order of magnitude with values which had previously been obtained from flow birefringence studies.

170 pages. \$2.25. Mic 56-3247

**MECHANICAL PROPERTIES OF CONCENTRATED  
SODIUM DESOXYRIBONUCLEATE SOLUTIONS**

(Publication No. 19,149)

Frances Holders Webb, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor John D. Ferry

The steady flow viscosity and dynamic mechanical behavior of solutions of sodium desoxyribonucleate (SDNA) have been studied to obtain new information about its molecular configuration.

The SDNA was extracted from calf thymus gland by a method which yielded a high molecular weight sample comparable with the best preparations from other laboratories. Measurements were made on more concentrated solutions than have been previously studied and usually in the absence of salt. Some measurements were made in a 50.4% glycerol-water solvent.

Non-Newtonian viscosity measurements were made on the more concentrated solutions by the falling ball method

**CHEMICAL EFFECTS OF NEUTRON CAPTURE  
IN SOME COBALTIC HEXAMINES**

(Publication No. 17,100)

Arvid Vernon Zuber, Ph.D.  
Columbia University, 1954

The cobaltic hexamine, tris-ethylenediamine, and bis-diethylenetriamine complexes were exposed to slow neutrons in the thermal column of the reactor at Brookhaven National Laboratory.

When solutions of the complexes were irradiated and then scavenged with cobalt hydroxide all of the Co<sup>60</sup> activity was removed by the hydroxide in the cases of the hexamine and ethylenediamine complexes. All but about 0.4 per cent of the Co<sup>60</sup> was removed in the case of the diethylenetriamine complex.

When the complexes were irradiated for twenty-four hours as solids, dissolved in water, and scavenged with cobalt hydroxide it was found that the following per centages of the Co<sup>60</sup> were not removed by the hydroxide: hexamine, 22 per cent; ethylenediamine, 20 per cent; diethylenetriamine, 20 per cent. On irradiating the solid ethylenediamine complex for one-half hour, dissolving it in water, and scavenging it with cobalt hydroxide, it was found that 15 per cent of the Co<sup>60</sup> activity and 15 per cent of the Co<sup>60m</sup> activity remained in solution.

After irradiating the tris-ethylenediamine complex for twenty-four hours it was found that 5 per cent of the C<sup>60</sup> activity was in the form of the complex.

It was found that heating the previously irradiated

tris-ethylenediamine complex caused an increase in the amount of Co<sup>60</sup> found in the form of the complex. Rate data for the recombination were obtained, and an analysis of these data was devised. The analysis showed that the recombination is described by two first-order rate constants. Activation energies of 20 ± 5 k. cal. and 25 ± 5 k. cal. per mole are associated with these rate constants.

In the solid 15 per cent of the activity is found in some form which is unaffected by heating, and which is not removed from the complex by scavenging with cobalt hydroxide. It appears reasonable that this fraction of the activity is in a stable chemical form, probably a complex ion, produced in the recoil process.

On irradiating the dextro form of the tris-ethylenediamine complex for twenty-four hours it was found that about 4.5 per cent of the activity appeared in the dextro form and about 0.4 per cent of the activity appeared in the levo form. After heating the irradiated complex, about 69 per cent of the activity appeared in the dextro form, and about 3 per cent in the levo form.

Although it may be concluded from the data that virtually 100 per cent of the neutrons captured give rise to sufficient recoil energy to either degrade the parent ion or escape it completely, the over-all picture appears to be consistent with much less disorder in the solid than might be expected to result from the recoil process. Furthermore, it appears that the levo complex formed on irradiating the dextro-tris-ethylenediamine complex is not formed by racemization within a metl produced by the recoiling atom but rather by thermal recombination processes.

77 pages. \$1.50. Mic 56-3248

## ECONOMICS

### ECONOMICS, GENERAL

#### UNION ATTITUDES TOWARD THE TAFT-HARTLEY ACT, 1947-1954

(Publication No. 17,137)

Erwin Simon Mayer, Ph.D.  
University of Washington, 1956

This study is concerned with union attitudes toward the Taft-Hartley Act, as they have developed between 1947 and 1954. Specifically, the following questions are raised: (1) what differences, if any, are to be discerned in the volume and in the content of union expressions of opinion regarding the Taft-Hartley Act? (2) in what manner and to what extent have union attitudes toward the Act been shaped by administrative changes in the policies and personnel of the National Labor Relations Board? (3) how are union attitudes toward the Act related to the position of unions vis-a-vis rival unions and vis-a-vis employers? (4) how has the passage of time affected union attitudes toward the Act? (5) what role do partisan politics play in union attitudes toward the Act?

The union attitudes studied, here, are those expressed in the official publications of twenty unions, among which are twelve A.F.L. unions, five C.I.O. unions, and three unaffiliated unions. These include unions in a variety of skilled trades, several unions in mass-production industries, and unions in coal mining and in truck, rail, and water transportation.

From these sources were abstracted substantially all expressions of opinion regarding the Act. These were classified into three general categories, viz., general issues, substantive issues, and procedural issues. In the first of these categories there are to be found those statements that deal with the Act in a general manner, and enunciate the policies to be followed, under the Act, by the various unions. In the second and third category there are found those statements dealing specifically with a variety of provisions of the Act itself. These expressions of opinion are analyzed in terms of their validity in the light of applicable decisions and other relevant data, in terms of the relative frequency of occurrence of the various arguments, and in terms of the development of the various arguments over time. An attempt has also been made to determine what basic attitudes, as conditioned by historical experience, appear to underlie the arguments about the Act.

The following general conclusions emerge from this study. To a major extent, unions are concerned with specific problems of operation under the Act, though there is a considerable amount of generalized comment, much of which is concerned with problems of adaptation to the Act. The major areas of concern appear to be, in the order of frequency of occurrence of comment, problems relating to union security, problems of adaptation to the Act, the injunctive provisions of the Act, the administrative machinery

and its functioning, and restrictions on strikes and on picketing. Much of the material, in a basic sense, is concerned with the supposed threat to the survival of the union as an institution.

There are considerable differences between the various unions in the amount of attention they devote to the Act, reflecting, it is believed, differences in their experiences with it. On the average, more comment is found from industrial unions than from craft unions. The major exception to this generalization is the I.T.U., which, because of circumstances apparently peculiar to that union, exhibits much concern over the Act. There are also considerable differences in the problems to which different unions tend to address themselves. In general, those unions classified as craft unions show more concern over substantive provisions, while industrial unions have paid more attention to procedural issues. This difference, it is argued, reflects the differences in the maturity of bargaining relationships and of power relationships. While considerable attention is devoted to the necessity for political activity, outright partisanship does not appear to play a major role in shaping union attitudes.

430 pages. \$5.50. Mic 56-3249

### THE SMALL WATERSHED PROGRAM IN WISCONSIN

(Publication No. 19,124)

Robert Charles Otte, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Raymond J. Penn

Both State and Federal policy has been evolving toward a small watershed approach as a part of the solution to the inter-related problems of flood control, soil and water conservation, forestry management and fish and wildlife conservation. Since 1945, approximately 50 watershed associations have been organized in Wisconsin. Agencies furnishing technical, material and financial aid for forest, wildlife and soil conservation have been integrating their individual programs so that they may be worked into a coordinated program for any given watershed.

In 1954, Congress passed Public Law 566 which provides Federal technical and financial aid to local small watershed projects, the financial aid being mainly for flood prevention features. The Act makes certain requirements of local people as a condition to receiving aid. There must be a local organization which can meet these requirements, and, in addition, have the powers and abilities to carry out a project successfully.

The objectives of this study were to determine (1) what has been done in watershed programs in Wisconsin without aid under Public Law 566; (2) what has been done in response to that Act; and (3) how these programs can be

made more effective and better adapted to the needs of local groups.

The study breaks down into three general parts: (1) a set of criteria with which to evaluate programs of this type; (2) a description and analysis of the programs of the several agencies participating; and (3) an evaluation of the total Wisconsin program.

Material for the study came from interviews with personnel of governmental agencies and officials of local organizations involved in watershed programs; from bulletins, reports and records of these agencies; from the Wisconsin Statutes and public records; from observations in the field; and from other studies of watershed and similar developments.

It was found that the technical, material and financial aid available can be used more effectively if there is a local organization which can take those portions of each agency's program which it needs and integrate these into a program for its area. There is a need, which could probably be best served by Extension, for aid in the organization of such groups.

If the group then feels they need a more elaborate program involving flood control structures, they may apply for aid under Public Law 566. The local units of government in co-sponsorship with soil conservation districts have together the necessary powers and abilities. While the watershed associations have no real powers, they may and should be a part of the planning and decision-making process.

There is a division of functions between the local units of government and the soil conservation districts which is offset in part by an overlapping of membership. This division of functions could be eliminated by giving the districts power to tax, to borrow money and to use condemnation procedures.

There is also a limitation on credit. Either the counties and towns or the soil conservation districts should be empowered to borrow for up to 20 years for watershed development.

General tax funds from the local units of government are the only source of funds. This makes for a discrepancy between the incidence of costs and of benefits. There is need for legislation enabling special assessments on the basis of benefits so that a local organization can use any combination of the two which meets its individual needs.

174 pages. \$2.30. Mic 56-3250

#### THE EFFECTS OF COST-OF-LIVING WAGE ESCALATORS ON GENERAL WAGE LEVEL MOVEMENTS: JANUARY, 1950, TO JULY, 1953

(Publication No. 19,265)

Benson Soffer, Ph.D.  
Princeton University, 1956

American wage escalators first became significant during the Korean war. These escalators automatically tied wage changes very closely to changes in consumer goods prices.

Escalator guarantees might have influenced the movement of non-escalated wages by: (1) tying expectations of wage increases closely to expectations of price increases,

and (2) intensifying attitudes that non-escalated wages should at least keep pace with escalated wages.

The following hypotheses were used for the study of the extent to which escalators influenced movements of the general wage level:

(1) The influence of escalators varies directly with the rate of increases in prices. That is, escalators have a very strong influence during a period of rapid price changes, but no influence during periods of price stability. (2) the influence of escalators varies directly with the relative importance of bargaining units using escalators. (3) the influence of escalators is greater, the closer the tie between wage changes and price changes in the escalator agreements. The most important single factor of the three listed above is the rate of increase in prices.

The best empirical data that can be used to test these hypotheses are chronologies of general wage rate changes. Chronologies for escalated and non-escalated wage changes were compared.

Groups of closely related wage bargaining units where wage movements had been uniform in the recent past were selected. Two general types of groups were used: (a) the automobile basic steel and closely related industries, and (b) several industry groups where there were strong short-run forces restraining wage level increases.

Chronologies of escalated and non-escalated wages were examined for lead and lag relationships. The accumulated amounts of wage increases for the period as a whole were also compared. Changes in escalator contracts and premature renegotiation of non-escalated wages were examined in relation to wage movements elsewhere in the economy.

The data indicate that escalators reduced the short-run inflexibility of wage rates during this moderate inflation. Escalators reduced the strength of forces delaying or limiting wage increases in textiles, railroads and printing. Escalators had their greatest influence on non-escalated wages during the period of rapid price level changes. At that time, negotiated wage movements in almost all manufacturing and transportation industries were very similar to escalated wage movements because: (a) many wage agreements were renegotiated prematurely, and (b) most of the other wage agreements were predicated upon further increases in prices, and hence escalated wages. During the period of gradual price changes, the spread of escalator increases to non-escalated wages was reduced.

Apparently escalators did not restrain the movement of non-escalated wages during the period of price stability. In this period, most escalator agreements were modified to permit wage movements similar to those negotiated in non-escalator agreements.

The evidence indicates that the "tightness" of the escalator tie, and the size of units using escalators had a slight influence on wage level movements. Such influences were limited to certain situations.

It seems, therefore, that escalators were able to influence non-escalated wages while prices were rising by tying expectations of wage changes to expectations of price changes and by establishing attitudes about the minimum wage increases acceptable to workers. We can surmise that escalators will have similar effects in any future moderate inflation.

279 pages. \$3.60. Mic 56-3251

**ECONOMIC IMPLICATIONS OF USING ALTERNATIVE  
PRODUCTION FUNCTIONS TO EXPRESS  
CORN-FERTILIZER PRODUCTION RELATIONS**

(Publication No. 18,006)

Anthony Paul Stemberger, Ph.D.  
North Carolina State College, 1956

Supervisor: Clifford George Hildreth

An economist in possession of production data faces the problem of specifying input-output relations before he can draw inferences as to the profitability of production alternatives. In principle, he has many models from which to choose an approximation to a production relation, but inferences regarding production possibilities may depend upon the function chosen.

A number of investigators have estimated corn-fertilizer production relations by fitting continuous models, such as polynomial, power, or exponential functions to experimental data. Most of these functions have given a good fit to the data, when goodness of fit is measured by the usual criteria of proportion of variance explained or as indicated by an F-test of goodness of fit.

The first step in this study was to compare various continuous functions, derived by other investigators as approximations of corn-fertilizer production relations, to determine whether economic implications differed among functions. Functions derived from three different experiments were investigated; within each experiment, as many as five different functions were available for comparison. Estimated optimal fertilization rates were derived for each set of functions. Mean optimal fertilization rates appeared to differ considerably depending on the function chosen for derivation. Some differences were obviously real; others may have been due to chance.

The second phase of the study was to utilize data, generated by a series of corn-fertility experiments conducted by the Agronomy Department of the North Carolina State College between 1944-1952, to approximate corn-nitrogen production relations. Fittings were attempted with three traditional discrete models, two continuous models, and a discrete model subject to the restriction of diminishing returns to nitrogen. To compare profitability of production alternatives, price maps were constructed for the discrete models and optimal fertilization rates derived for the continuous models. Essentially the same production alternatives were possible with all models but the limits over which a given alternative is most profitable were somewhat different.

A discrete model (point estimate) subject to qualitative restrictions gives the economist an efficient and unbiased estimate of underlying production relations without forcing him to specify a given algebraic form. However, use of this technique, in its present state of development precludes placing confidence limits on estimates or making statistical tests for differences. Furthermore, placing restrictions on more than one factor may result in excessive computations.

For most profitable production, fertilizer recommendations should be based on fertilizer-output price ratios. The economist needs especially designed experiments to provide the data required for a thorough economic analysis of agronomic production relations. Application of experimental results to commercial situations must be tempered by judgment.

130 pages. \$1.75. Mic 56-3252

**MANPOWER, PRODUCTIVITY AND  
UNDEREMPLOYMENT IN WISCONSIN FARMING  
SINCE 1939**

(Publication No. 17,343)

Kyunhi Tchah, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Kenneth Parsons

The study is aimed at clarifying the understanding of the following aspects of the Wisconsin farm labor situation since 1939: (1) relative position of labor earnings, (2) the structure of the farm labor force, (3) changes in the supply of, and demand for farm labor, and (4) the rates of improvement of farm labor productivity and the extent of under-employment of labor on Wisconsin farms.

This study is a partial analysis of schedules taken in 1951 on a total of 1659 Wisconsin farms, chosen at random. The general procedure of the analysis was to construct a framework of reference for each aspect of the subject, largely from Agricultural Census data and the USDA indices related to the agricultural economy. The details of the cross-sectional and localized analysis of the data of the survey were then interpreted with reference to this broader framework.

The income discrepancies between farm and non-farm people, and among farm people has become more acute in the recent years. The family farm remained the dominant type of operating farm business over the period 1943 to 1950. The family has continued to be the major source of labor supply during the period, with 86% of the total farm labor being supplied by operators, their sons and their wives. The farm operators did 56% of the farm work; the sons, 12%; and the wives, 18% in 1950. The relative contribution made by sons and hired labor to the total farm labor supply declined by 4% and 3% respectively over this same period. Farm wives participated more actively as laborers in the farming in 1950 than in 1940.

Farm population decreased by 16.5% from 1940 to 1953. Farm employment declined by 13.6% in the same period. Farm production increased by 31% from 1939 to 1953. As a consequence the production per man-hour on dairy farms increased by 78% during this period, 1939 to 1953. With the total man-hours of labor required by the agriculture of the state declining 26% over the period 1939-53, it was estimated that there was an excess supply of labor in 1953 equivalent of a 12% of the total labor supply in 1939.

Approximately a quarter of the farm families of the state were underemployed in 1950, according to the estimate of this analysis. Another one third of the total families were on the brink of underemployment as of the same year, when compared to average income for non-farm families. The proportions of underemployed families to the total number of farm families in each area in 1950 were as the follows: 48% in U.S. Census area 1 and 5; 16% in Census area 7; and 20% in the rest of the state. According to the estimate of this analysis, 16.4% of the total labor hours nominally used on Wisconsin farms in 1950 was physically underemployed, or wasted. The proportions of physically underemployed labor to the total labor used in each area were as follows: 20% in area 1 and 5; 11% in area 7; and 14% in the rest of the state. The low production and low income of the underemployed families was largely due to the lack of income generating resources other than labor.

The productivity of farm labor in the state has been increasing remarkably in the recent years; however, the total output on Wisconsin farms has been leveling off. Thus an excess supply of manpower seems to have been piling up in agriculture. This is associated with the deterioration of farm income in recent years. As the non-farm sectors of the economy grow, the relative income position of Wisconsin farms hold the prospect of becoming worse, unless there is a major reorganization of the resource use pattern in Wisconsin farming. In the long run context, the author is inclined to the economical interpretation of the farm problem, this requires a basic approach to the problem as suggested by the formula - fewer people and higher productivity per worker in agriculture.

155 pages. \$2.05. Mic 56-3253

#### ECONOMICS, COMMERCE - BUSINESS

**THE COOPERATIVE DEPARTMENT STORE:  
AN ECONOMIC ANALYSIS OF THE ATTEMPT  
TO ESTABLISH A CHAIN OF COOPERATIVE  
DEPARTMENT STORES AS VISUALIZED**  
BY EDWARD A. FILENE  
(PARTS I-IV)

(Publication No. 17,211)

Martin Luther Bell, Ph.D.  
University of Pennsylvania, 1956

Supervisor: Dr. Reavis Cox

This dissertation is an analysis of a recent and novel experiment in consumer cooperation. It examines Edward A. Filene's plan for a "league of cooperative department stores." Filene's successful retailing career convinced him that there are avoidable wastes in marketing. His analysis of the macro-economic process led him to endorse a system that, in his belief, would improve the efficiency of distribution, enhance consumer purchasing power, and sustain employment. In addition, Filene longed for personal recognition. These various considerations led him in 1933 to propose a chain of 100 consumer-owned department stores. However, nothing beyond the incorporation of a central management and buying organization (Consumer Distribution Corporation) was accomplished before Filene died in 1937.

After Filene's death, the department store project was abandoned until 1943. In the intervening period Consumer Distribution Corporation and its holding foundation, the Edward A. Filene Good Will Fund, to which Filene had left the bulk of his fortune, attempted to promote consumer cooperation in other ways. The dissertation touches on these activities. Summary analyses are presented of the following programs: (1) sponsorship of urban cooperatives, (2) management consulting, (3) loans to cooperatives, (4) sale of equipment, and (5) cooperative training and promotion.

In 1943 the Filene organizations revived the department store project and adopted a modified version involving three stores with projected sales of \$1,500,000 each. The

principal concern of this dissertation is a critical evaluation of this project.

By 1949 only two stores had been opened--one outside Washington, D. C., and another in Providence, Rhode Island. The Providence store never operated profitably and was closed in 1951 with a total loss of about \$1,500,000. The Washington store fared somewhat better. It paid modest dividends on stock in 1950 and 1951 and a small patronage dividend in 1951. Like Providence, however, it never succeeded in selling 10 per cent of its common stock and was closed in 1953 with a loss of approximately \$500,000.

The dissertation devotes attention to the merchandising and cooperative achievements of each store. The stores encountered inadequate sales volume, weak gross margins, and expense rates geared to volumes of sales higher than could be achieved. As cooperatives, the stores failed completely to obtain consumer underwriting or acceptance by the existing cooperative movement.

A summary generalization indicates that the failures are attributable to (1) errors in planning, (2) mistakes in implementing the idea, and (3) uncontrollable outside factors. In addition, the dissertation draws the following lessons from the experience:

(1) This experiment has not indicated that the promotion of large-scale cooperative enterprise is either impossible or impracticable; but it shows that such a program certainly would be a difficult, expensive, and protracted project.

(2) Mistakes and achievements were both involved in this project and any future attempt should draw on the lessons of both.

(3) Whether another attempt should be made depends upon our ability to determine if large numbers of people will support large-scale cooperative enterprises when these are efficiently managed.

(4) The advocates of the so-called "top-down" and the "bottom-up" methods of cooperative organization may find a compromise in the dissertation's proposed "centralized" type of organization.

(5) The evidence available in this study supports the propositions that large-scale cooperative enterprise as here encountered offers little competitive threat to American retailing and that there is slight reason to expect Americans to support cooperative enterprise to the point where they evolve a "cooperative commonwealth."

(6) Although the endeavor dissipated Filene's fortune, this dissertation judges it to have been generally worthwhile. Our knowledge of cooperation and its place in our economy have been enriched by it.

The dissertation should prove interesting to the co-operator, to the economist, to the marketing theorist and practitioner, and to the consumer who, in the last analysis, stood most to gain from the grand project envisioned by Edward A. Filene.

541 pages. \$6.90. Mic 56-3254

**THE THEORETICAL INTEREST CONCEPT IN  
MANUFACTURING EQUIPMENT REPLACEMENT**

(Publication No. 19,069)

Hilary Raymond Beth, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harold E. Kubly

The aim of this study was to determine whether or not theoretical interest is a factor in the problem of manufacturing equipment replacement as that problem is met in the day-to-day operation of a manufacturing company.

The method of the study was to employ two approaches: (1) a survey of equipment replacement literature to determine what the different writers believed the relationship should be between theoretical interest and equipment replacement; and (2) personal interviews with representatives of manufacturing companies to determine the company's approach to manufacturing equipment replacement and the place of theoretical interest in that approach.

The twenty-six companies contacted in the course of this study were selected from the 1955 Classified Directory of Wisconsin Manufacturers. The sample was designed to give a representative cross-section of American industry. It includes manufacturers of capital goods and consumer goods and types of manufacture from job lot to mass production, from intermittent to continuous.

Of the twenty-six companies contacted, eight employ theoretical interest as an integral part of their approach to equipment replacement problems. Eighteen of the firms gave no weight or consideration to the concept in such problems.

Approximately one-third of the firms employ the concept in replacement problems, but no evidence was found that those firms fully grasp the meaning of the concept. It is not used in the economic sense of "opportunity cost" as that concept was developed by Herbert J. Davenport in his *Economics of Enterprise*, or as that concept is related to manufacturing equipment replacement by more recent writers. It is used rather as a rate of return or interest-as-a-cost concept and as such does not play a significant part in equipment replacement.

It can be said that the concept is not of great importance in current equipment replacement practices and policies. Until industry develops a more objective and long-range approach to replacement, theoretical interest will not be an important factor in relation to equipment replacement.

142 pages. \$1.90. Mic 56-3255

**EDUCATIONAL CONFERENCES SPONSORED BY  
SCHOOLS OF BUSINESS IN BIG TEN UNIVERSITIES**

(Publication No. 19,274)

Edward James Kuntz, Ed.D.  
Indiana University, 1956

Chairman: Elvin S. Eyster

**The Problem**

This is a study of business conferences, institutes, and executive programs of Big Ten universities. The study

includes an examination of the objectives and policies underlying educational conference programs, the procedures and practices followed in administering these programs, the benefits derived, and the trends that may be emerging in this field of continuation study.

**Procedure**

Primary data for the study were obtained by visitations and interviews with deans and other administrative officers responsible for educational conferences in business administration in Big Ten universities. A comprehensive tabulation of all of the facts thus obtained was derived from a series of visitation summaries prepared for each of the schools included in the study. Further data concerning educational conference procedures and practices were obtained from a study of university catalogs, conference and institute programs, syllabi, course outlines, and published conference proceedings.

**Findings and Emerging Trends**

The educational conference program in the Big Ten universities is providing one means for extension of the traditional university objectives of knowledge advancement and dissemination. This expansion is reflected in the three major objectives of business educational conferences: (1) to provide an educational service to lay and professional groups, (2) to aid in research, and (3) to enrich the business administration curricula. General policies guiding the administration of educational conferences fall within the framework of these objectives; and these policies govern the number and acceptability of educational conferences, degree of centralization of responsibility, scheduling, specialization by subject-matter, financial support, and publication of proceedings. In general, an emerging trend is toward the formulation of policies favorable to educational conference growth.

A study of the benefits derived from educational conferences reflects the success with which the university engaging in these activities is accomplishing its basic objectives. The groups served by educational conferences benefit as the knowledge in specified areas of business administration is advanced through the educational conference program. Further, because these group meetings reach persons not otherwise served directly by the university, the conference programs extend benefits to important segments of the business community that probably cannot be reached through other types of continuation study. Some benefits also may accrue to the university, particularly in the areas of public relations, development of faculty members, and research.

While educational conference administrative practices differ from school to school and from one conference to another, certain trends are emerging. One trend is toward the adoption of policies leading to the centralization of responsibility for the planning and administration of the educational conference program. The trend in direction of conference administration is toward greater specialization and personal supervision. As a matter of policy, the educational conference is almost always self-supporting. Promotional work, some designed to attract educational conferences to the campus and some designed to attract persons to attend scheduled group events, is expanding with the growth of conference activities.

The continued expansion of educational conference programs presents new problems to be met as the need for additional faculty personnel, expanded physical facilities, and adaptations of organizational structures becomes more acute.

143 pages. \$1.90. Mic 56-3256

**AN ANALYSIS AND EVALUATION OF THE MARKETING OF TEXTILE CLOTHING BY WESTERN CANADIAN MANUFACTURERS**

(Publication No. 18,805)

William Lazer, Ph.D.  
The Ohio State University, 1956

**Statement of the problem.** Despite the economic importance of Western Canadian garment manufacturing, little investigation has been made of this industry. Moreover, the problems of marketing garments, which are more acute than the acknowledged problems of physical production, are ignored. The dissertation analyzes and evaluates the marketing of textile clothing by Western Canadian garment manufacturers, with particular reference to Manitoba establishments. Included are considerations of the performance of the marketing functions, the channels of distribution, and the policies and procedures adopted.

**Methodology.** Empirical information was gathered through personal interviews with a non-random sample of twenty-six Manitoba garment companies. The sample, which included the largest and most progressive firms, represented an estimated 30 per cent of the Manitoba textile clothing production of 1954. To record the information conveniently, and to guide the interviews, a questionnaire was employed. Survey information was supplemented by informal interviews with salesmen, manufacturers' agents, regular wholesalers, government officials, trade association personnel, and material from published sources.

**Results.** Western Canada's garment industry approximates conditions of nearly perfect competition, realizes economies at modest scales of production, provides jobs rather than investment opportunities for owner-operators, is comprised of one- or two-family-owned concerns, has a high company turnover, and occupies a low status position. Manitoba firms dominate the Western Canadian industry. In 1952, they accounted for over 72 per cent of the industry's factory shipments and over 58 per cent of the establishments. The progressive bundle system of production is employed in Manitoba. Significant quantities of men's work clothing and ladies' suits and cloaks are manufactured, and the relative output of sports and style clothing is increasing.

Manitoba garment manufacturers are haphazard in the selection of product lines, and neglect the development of product standards. In addition, they do not exercise adequate inventory controls, fail to utilize systematic or scientific methods of solving sales problems, and ignore accepted sales management functions and practices. Sales, which are concentrated in Western Canada, are made through company salesmen supplemented by manufacturers' agents. Wholesale establishments handle a small proportion of garment sales. At the retail level, department stores and chains are important outlets, but manufacturers are attempting to expand their sales to independent retailers.

Pricing objectives of Manitoba garment manufacturers are "fair" returns, survival, market entry, maintenance of market positions, and extension of full-price ranges. Generally, the cost-plus method of pricing is employed. In specific instances, the methods of intuitive pricing, introductory pricing, direct-cost pricing, premium-margin pricing, price imitation, full-range pricing, monopsony pricing, prestige pricing, and product tailoring are used. Keen price competition, offering of trade discounts, and price lining are characteristic of the Manitoba garment industry.

Transportation charges hamper only the sale of staple garments to Eastern Canada. Storage charges are low, and in-plant storage prevails. Marketing information is ignored as a management aid. While manufacturers emphasize the importance of adequate financing, financial planning is disregarded. Credit management is merely conceived of as minimizing losses; resulting credit losses are negligible. Owner-management predominates, and planning, organizing, and controlling of marketing activities are neglected.

**Conclusions.** The findings of the dissertation disclose that marketing considerations can logically and profitably guide the physical production activities of Western Canadian garment concerns. Moreover, it is apparent that the marketing situations faced by the industry are not unique. Manufacturers can benefit by recognizing the significance of distribution problems, adopting accepted sales management practices and marketing research techniques, and employing competent managerial personnel and adequate training programs. The study reveals the necessity of raising marketing operations to a level commensurate with the technical efficiency of garment production.

297 pages. \$3.85. Mic 56-3257

**ECONOMICS, FINANCE**

**CREDIT FOR GREEK FARMERS**

(Publication No. 18,569)

Antonios Lucas Adamopoulos, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. Frank Miller

The objective of this study is to reveal the possibilities of improving Greek agriculture through the use of credit. The analysis shows that any attempt to solve agricultural problems will need to be coordinated with industrial development, expansion of handicraft, intensification of the tourist trade, and improvement in commerce between Greece and other countries.

Several obstacles appear when the problem is approached along this path. Only 27.2 percent of the area of Greece is suitable for crop production; yet 57 percent of the labor force is engaged in agriculture. The soils are not very fertile. The average farm is only 2.0 hectares in size and is fragmented into several plots at varying distances from the rural villages where farm families live. Most of the equipment is primitive as compared with modern commercial farming standards.

Under these conditions, the Greek farmer and his family are underemployed. Their efforts are not very productive. They are owner-operators, but most of their equities are invested in high priced land. They have very little working capital. The annual farm income is about \$98 per capita, and practically all of it is used for food, clothing and other necessary expenses. Very little is left for capital maintenance or increase.

There is very little industrial development in Greece. Large quantities of manufactured goods and several important types of food are imported. These items have a constant demand. The exports consist mainly of agricultural products such as tobacco and raisins, with highly variable demand. The balance of trade has been negative for years. The deficit has been financed through foreign loans and economic aid. As a result, Greece owes a tremendous foreign debt. Her geographic position has made it necessary for her to spend a high percentage of public revenues for defense. Efforts on the part of the government to meet expenses and provide funds for economic development through monetary policy and other factors that influence the general price level have led to a continuing inflationary trend, which has encouraged hoarding of metallic money and foreign currency. This situation has created instability in the banking system.

Greece has important quantities of lignite coal and other minerals. The use of water power for generating electricity can be expanded. These resources can be used for industrial development. The problem is, how to finance the initial steps.

The Greek farmer needs funds for crop and livestock production as well as for land improvement, irrigation, consolidation of holdings, and other changes in his business to improve his income. Credit can be used to meet this need. Some progress along this line has already been made as a result of loans through the Agricultural Bank of Greece. Further advancement calls for adoption of a policy of national development and the initiation of programs that will lead to improvement in both the farm and non-farm sectors of the economy.

The programs used to advance this policy should include credit to aid farmers in establishing profitable farm businesses, power development for industries that can provide employment opportunities for workers who are not needed on farms, expansion of irrigation, revision of the educational system to provide widespread vocational training for rural people, expansion of trade with other countries, and encouragement of the tourist trade in Greece. The government can help to initiate these programs by using public funds to get them started, by reducing military expenditures, by encouraging small savings to build up the total amount of available capital, by stabilizing the price level through wise monetary policy, and by encouraging investment of foreign capital in Greek economic development.

211 pages. \$2.75. Mic 56-3258

## THE DEVELOPMENT OF CENTRAL BANKING AND THE FINANCIAL CRISES IN MEXICO

(Publication No. 17,299)

Virgil Marion Bett, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Walter A. Morton

The banking system of Mexico was virtually destroyed by the Mexican Revolution, (1910-1918) and the Mexican money supply was reduced to the insufficient metal currency of the nation. The victorious leaders of the Revolution desired to create a government controlled central bank as the center of a new banking system. Lack of funds or credit compelled them to delay this action until 1925.

The Bank of Mexico was established in 1925 and the Government purchased a majority of the stock. The Bank functioned, for the first five years of its life, both as a central bank and as a commercial bank. Gradually, thereafter, it evolved into an effective central bank and gave up its commercial banking activities.

The Bank of Mexico gradually increased its strength and its service to the nation largely as a result of its responses to a series of crises in the Mexican economy. Its first response to depression, in the 1930's, was to restrict the expansion of silver money in order to maintain the exchange rate. At the same time the public began to accept Bank of Mexico notes in significant quantities. The Bank was then in a position to employ an expansionary policy based upon note issues. Such a policy was adopted in 1932 and contributed much to the growth of the Mexican economy, but it left the peso largely unsupported on the foreign exchange markets.

In 1935 there was a rise in the price of silver. When this price exceeded seventy-two cents per ounce, Mexican silver coins were worth more as a commodity than as money. Mexico demonetized silver and called it in with the hope of selling it. Bank of Mexico notes became the only legal tender money in Mexico and the position of the Bank was greatly strengthened. With the passage of the law of 1936 the Bank of Mexico became an effective central bank with the power and authority to influence the economy significantly.

In the late 1930's the Mexican Government was engaged in a program of development and reform. Land was redistributed to the villages, foreign held oil properties were expropriated and the railroads were nationalized and turned over to the workers. Schools and roads and other service facilities were built. The Bank of Mexico was engaged in financing these programs, but once more the foreign exchange rate suffered. The reforms discouraged foreign investments and prejudiced foreign markets against Mexican exports so that the Mexican balance of trade could not be maintained.

The development of the Bank of Mexico was largely determined by forces outside itself and often outside of Mexico; forces over which it had little or no control. Gradually, however, its capacity for independent action was increasing.

The Bank of Mexico faced an almost perpetual dilemma; whether to finance economic development at home and allow the peso to fall in value on the foreign market, or to support the peso and restrict the economic development and growth of the country. Between 1925 and 1940, the

peso fell from a rate of about two to the dollar, to almost six to the dollar.

The nation could not escape from this dilemma by banking and monetary policy alone.

Fiscal and foreign trade policy might have been used together with monetary policy to support the value of the peso, and at the same time to assist in the economic development of the country.

Further studies should be made of the operation of the Bank of Mexico after 1940, and of the fiscal and foreign trade policies of Mexico since the Revolution.

302 pages. \$3.90. Mic 56-3259

#### DURABILITY OF CONSUMER GOODS AND BUSINESS INSTABILITY

(Publication No. 17,303)

Pao Lun Cheng, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Walter A. Morton

Business cycle theories that employ aggregative and homogeneous concepts in their analysis tend to be inconclusive. Instead we break down the consumer goods in aggregate into categories in terms of their different degrees of durability and divisibility, and observe their behavior over cycles from 1919 to 1954. We give the concepts of durability and divisibility statistical and operational definition, by defining durability of a consumer good as the rate of turnover of the good in a stock of consumer goods and divisibility as the ratio of its replacement cost to the income size of its owner-consumer. We classify the demand for consumer goods into new user demand, replacement demand, augmentation demand and abatement demand, and cast them into a cyclical context.

The method employed is mainly based upon the work of the National Bureau of Economic Research. Whenever and wherever possible, monthly data are used in preference to annual data.

The results of our investigation:

1. The later the business cycles occurred after the period when the stocks of consumer durables were exhausted, (1) the demand for consumer durable-indivisible goods showed signs of weakening during expansions as well as contractions; (2) the inventory disinvestment in consumer durable-indivisible goods industries during downturns had a tendency to increase.

2. On the other hand, the nondurable-divisible consumer goods sector tended to strengthen and the producer goods sector tended to exhibit unusual confidence and vigor. In an economy where resource-allocation is specialized and immobile, the weakened consumer durables sector tends to render the economy vulnerable for a downturn despite steady growth in the other sectors. Thus, the farther the cycle is away from wars or severe depressions, the more numerous are signs in the consumer durables sector initiating a cyclical downturn.

3. The portion of consumer durables expenditures financed by instalment credit is greater during the post-World War II period than during the post-World War I period. The study observes that the relatively greater por-

tion of instalment credit in consumer durables expenditures means: (1) greater ease for consumers to allocate income for purchasing durables, and (2) greater "forced saving" through instalment debt repayment during recessions at the expense of consumer nondurables expenditures. Consequently, (1) the post-World War II mild recessions showed less strength and growth in consumer nondurables expenditures than in the interwar mild recessions, and (2) the portion of durables expenditures in total consumer outlay exhibited a trend of growth at the expense of that of the nondurables expenditures.

The study suggests that the element of instability in the consumers' sector seems to lie in the bunching of demand for durables by the masses, rather than by the alleged over-saving of the rich. Thus, any counter-cyclical policy for the consumers' sector should differentiate the temporal position of the cycle in question. Controls over the demand for consumer durables in the cycles immediately following periods of stock exhaustion should be stringent. This will break up the bunching in the "early" cycles and postpone the date of saturation of consumer durables stocks. As a result, the long-run expansion phase of the economy will be elongated. Furthermore, a successful breaking-up of the bunching of the demand for them will provide a cushion against severe contraction of the nation's total economic activity through a greater growth of the consumption of nondurable consumer goods, since the latter exhibited a great degree of stability over the cycles. Thus any policy, monetary or otherwise, that can encourage the relative strength and growth of the consumer nondurables sector, can reduce the amplitude of business instability as a whole.

405 pages. \$5.20. Mic 56-3260

#### JUSTICE IN TAXATION: A THEORETICAL ANALYSIS

(Publication No. 17,601)

Charles Dwight Clement, Ph.D.  
University of Virginia, 1956

With taxes taking over one-fourth of the national income in many nations, their effects upon economic activity are profound. With such a large tax burden, any injustice in distributing it can result in great injustices.

The basic question is simple: is not a just tax system to be preferred to an unjust one? Two problems arise in answering this question. First, what standards are to be used in deciding whether a tax system is just or not? Second, what are the "costs" of justice in a tax system? Justice in taxation is like justice in law or in the economic system; there is no agreement as to what constitutes justice. Furthermore, the generally accepted concept of justice (as shown by a system of law, for example) is not static but varies with time and circumstance.

Several principles of justice in taxation have been used to defend various changes in tax systems. A study of these principles should lead to a better understanding of the problem of justice in taxation.

The benefit principle states that if a person receives a good from government, it is just that the person pay government for it. It is not clear what price is just, some say a price equal to the value of the good to the person,

others say it should equal the cost of producing the good. The value of goods approach corresponds to a monopoly price for non-government goods while cost of goods corresponds to a purely competitive price for non-government goods.

A neo-classical economist would logically seem to be required to accept not only the benefit principle but also to accept the cost of goods measuring rod for government prices. However, he can logically reject both if he believes that government goods are basically different from non-government goods.

Government goods are different from other goods in at least two ways: many such goods are intended as subsidies, and second, government goods are distributed on a compulsory basis. A problem arises from this second characteristic of government goods as some citizens are unable to pay for them.

Another complication arises from the fact that government makes many decisions to use taxes to regulate economic activity or to correct injustices existing outside the tax system. These factors plus the fact that many benefits are seemingly impossible to measure, very clearly leave the benefit principle much less than an ideal standard for measuring justice in a tax system.

Similar objections can be found for the other principles of justice in taxation. For example, sacrifice principles are based upon very questionable assumptions concerning the marginal utility of money and interpersonal comparisons of utility. The ability principle seems to imply that a free market that does not charge according to ability is unjust.

In addition to the absence of any generally acceptable principle, is the fact that the principles put forth only provide a standard for measuring justice in a static economy. A tax system may be just in the short run but if it also reduces the rate of progress it may cause great injustices in the long run.

There is clearly no ideal or perfect standard for measuring the over-all justice of a tax system. Yet every nation must and does make decisions that some citizens must pay more taxes than others. Such decisions affect not only the well-being of individual citizens but also the well-being of the nation.

493 pages. \$6.30. Mic 56-3261

in Wisconsin; and newspaper articles, personal interviews, and selected text material which provided historical information concerning the growth and development of savings and loan associations in Wisconsin.

An historical description of the growth, changes in character, and operating methods of Wisconsin savings and loan associations was coupled with trend and ratio analysis of financial statements in order to provide a detailed account of their development. Comparative financial statement analysis was the principal method used to evaluate the present condition of Wisconsin savings and loan associations.

Savings and loan associations in Wisconsin evolved from small, mutual, neighborhood associations, which were organized to provide homes for their members, into one of that state's most important types of home financing and savings institutions. Changes in the operating methods for both the savings and lending aspects of the business were made to facilitate growth and development. The depression of the 1930's provided the only serious setback to the progress made by Wisconsin's savings and loan associations. However, improvements in operating methods and in the general financial condition of the real estate business which grew out of the depression of the 1930's undoubtedly established a more stable foundation for their business. Following the depression of the 1930's, Wisconsin savings and loan associations continued to expand their volume of business. Toward the end of the period covered by this study, they were making almost 50 per cent of the home loans made in Wisconsin and were gathering an increasing proportion of the savings placed in the major savings institutions in that state.

Comparisons were made with other savings and loan institutions in the United States. Factors compared were: rate of growth, liquidity, classification of mortgage loans, retention of new savings, insurance of accounts, reserves and undivided profits, and income and expenses. Wisconsin associations compared favorably, on the basis of this analysis and the statistics available, with other savings and loan associations in the United States. While neither present standards of operation of savings and loan associations nor the various federal programs have withstood the test of a major depression, it was concluded that, on the basis of the comparisons made in the study and the conservative operating practices followed by associations in the state, Wisconsin savings and loan associations were in a relatively healthy condition.

332 pages. \$4.25. Mic 56-3262

#### GROWTH AND ECONOMIC DEVELOPMENT OF SAVINGS AND LOAN ASSOCIATIONS IN WISCONSIN

(Publication No. 18,787)

Robert Clarence Earnest, Ph.D.  
The Ohio State University, 1956

The purpose of the dissertation is to examine the growth and development of the savings and loan business in the state of Wisconsin from 1876 to 1954; to record significant changes in the operation and character of the business; and to analyze its present condition.

The primary sources of information used in the preparation of the study were the annual combined financial statements of Wisconsin savings and loan associations published since 1897; the compiled financial statistics on savings and home lending for savings and loan associations in Wisconsin, the United States, and competing institutions

#### BENJAMIN GRAHAM AND JAN GOUDRIAAN'S INTERNATIONAL COMMODITY RESERVE CURRENCY PROPOSAL: AN EVALUATION AND COMPARISON WITH OTHER SOLUTIONS TO THE PROBLEM OF RAW MATERIALS

(Publication No. 19,244)

Elmer Meredith Harmon, Ph.D.  
Columbia University, 1956

Prices of primary products fluctuate widely. These fluctuations cause a number of difficulties in the world economy. In under-developed areas, political instability,

retarded development, and inflation are generated. In more developed areas, price and employment fluctuations are intensified. Price destabilizing speculation resulting because of wide price movements leads to a chronic misuse of the current stock. Larger than necessary risk has lead to a dearth of capital in primary production. And individual producers, hard pressed to manage their finances prudently in such an uncertain world, have successfully petitioned their governments for cartel-like marketing arrangements which exact from the world economy a heavy toll in wasted resources.

With the moderation of the foregoing difficulties as their objective, a number of reform proposals have been advanced calling for a reordering of marketing arrangements in primary production. Most of these proposals would interfere rather seriously with the allocation of resources. Others are difficult to reconcile with our predisposition for a private enterprise system.

The Graham-Goudriaan Proposal (GGP), on the other hand, offers a refreshing alternative. The mechanical operation of GGP is simple and automatic. The promised advantages are many. The basic building block is the concept of a commodity-unit consisting of a specified number of standard storable commodities in fixed physical proportion. Commodity-units would be purchased (sold) in unlimited amounts were the price of the unit to fall (rise) a given amount below (above) a stated stabilization level. The price of the group of commodities would be stabilized while the relative prices of the individual commodities would be free to change.

The major advantages expected to flow from GGP can be summarized briefly in the following five points:

1. GGP would reduce income fluctuations to individual primary producers and help them to adjust to whatever income fluctuations remain. A reduction in chronic hardship because of chronic fluctuations in capacity to consume is implicit. Political sub-divisions consisting predominantly of primary producers would be assured a more stable import capacity. Problems of development, currency convertibility, domestic inflation, and continuity of local government services in depression would thereby be less.
2. GGP would improve the use of both resources and the current stock of primary commodities. Resource use would be improved through the reduction of capital rationing, un-economic diversification, and industrialization contrary to comparative advantage; as well as through the encouragement of labor to quit primary production and to enter other pursuits when its reward in primary production is relatively low. Use of the current stock would be improved through the reduction of price destabilizing speculation (*i.e.*, through forcing a time pattern of stock depletion which would more nearly maximize the present value of any given stock).
3. GGP would provide a significant and additional measure of built-in flexibility. In the event of a deficiency in aggregate demand, GGP would bolster income received by primary producers just as unemployment insurance would bolster the income received by industrial workers.
4. GGP would provide an ever-present stockpile of raw materials -- an invaluable asset to the free world in the event of war.
5. GGP would dampen the incentive to cartellization in primary production and blunt the political claim of primary

producers to public protection thereof. State production and marketing controls with all they imply about the improper use of resources and threats to individual liberties might then be easier to eliminate.

183 pages. \$2.40. Mic 56-3263

#### THE STATEMENT OF APPLICATION OF FUNDS IN MODERN CORPORATE ACCOUNTING PRACTICE

(Publication No. 18,801)

Jack J. Kempner, Ph.D.  
The Ohio State University, 1956

The primary objective of the study of the application of funds statement in modern corporate accounting practice was to determine the extent of current usage and to obtain the reactions of those whose task it is to interpret financial data. Since the funds statement is basically designed to disclose the flow of working capital, it seemed pertinent to investigate the desirability of elevating the statement to the status of a major financial exhibit.

The first part of the study was concerned with an historical development of the funds statement followed by a discussion of its modern concepts, with emphasis on the underlying purpose of the statement. The major phase of the study involved an inquiry into current practice. Data was obtained from extensive questionnaires mailed to firms of certified public accountants, bank loan officers, and security analysts. In addition, a suitable number of corporate annual reports published during the past decade were investigated, and finally an analysis was made of a recent study of management's use of the funds statement for internal reporting purposes.

Accountants were asked to specify the use they made of the funds statement in their audit reports, the attitude of their clients toward the statement, and their form and methods of preparation. Bank loan officers and security analysts were requested to indicate their own experiences in the use of the funds statement and to tender their opinions with regard to various aspects of the statement. Corporate reports were studied in order to determine the extent to which funds statements were included in these reports.

The results of the study revealed that a relatively small proportion of corporations include the funds statement in their annual reports. Nevertheless, there has been a substantial increase in the submission of these statements over the past ten years. More than eighty per cent of the bank loan officers who received questionnaires returned them, emphatically stressing the importance of the funds statement for an adequate analysis of their customers' financial activities. Accountants furnished evidence that although most of them have not yet established the funds statement on an equal basis with the balance sheet or income statement, the trend is progressing in that direction. Security analysts seemed to find less need for this report than bankers or business executives.

Most accountants and readers of financial reports prefer a continuation of a working capital approach rather than an emphasis on the cash balance. Corporate managers, on the other hand, favored a cash approach for internal reporting purposes since they were more concerned with the

highly liquid funds required to meet payrolls and short term loan obligations. The survey further indicated that many businessmen found it easier to appreciate the flow of their financial resources through a study of the funds statement than by reviewing the balance sheet or income statement alone. The former statement more clearly discloses the sources from which funds were derived and serves to summarize the manner in which management has handled the disposition of these funds.

Of particular significance, the report emphasizes the inevitable discrepancy that exists between reported book profits and funds made available through operations. This emphasis is accomplished by eliminating the highly subjective depreciation charge from the statement.

The following recommendations were made as a result of the study. Continued use of the working capital approach seems preferable except for purposes of internal reporting, in which case the cash balance approach may be favored. No rigid form of funds statement is advocated, but accountants should avoid highly complex reports unless they are prepared for their own use. The highly successful use of budgets and projected financial statements in recent years warrants the inclusion of predictive funds statements as well. Finally, in view of the vital funds flow data contained only in this statement, public accountants are urged to treat it as a major financial exhibit, rendering an opinion along with the balance sheet and income statement.

265 pages. \$3.45. Mic 56-3264

#### AN INVESTMENT ANALYSIS APPROACH TO STOCK LIFE INSURANCE COMPANIES

(Publication No. 17,923)

Edward Axel Nelson, Ph.D.  
University of Missouri, 1956

Supervisor: Professor Truman G. Tracy

Little has been written to guide investors in their quest to select common stocks issued by life insurance companies offering investment potential. This study sets forth an outline covering the major areas for analysis and applies the outline to the industry. Emphasis is given to those unique features resulting from the industry structure.

The approach covers five sectors, industry life cycle, the company's position within the industry, earnings and dividends, financial statements, and management. First, the life insurance industry's life cycle was examined to determine its profitability for investors. After establishing the growth phase characteristics of this industry, the other areas were presented to disclose what information was available and how to interpret these facts.

Within the company, home office and field force qualities were investigated to show which ones held promise of future profitability. The competitively superior companies tend to be the life corporations that make the earliest and greatest use of the favorable industry trends.

In the presentation of earnings and dividends, two characteristics were disclosed, the consistently low pay out ratio and the general tendency to distribute stock dividends. To approximate the future long run earnings for any life company, the past record for eleven years should be stud-

ied, 1945 through 1955. This is a representative cyclical period for the industry.

Company financial statements offer quantitative facts to support the judgments. The company's annual report to owners, or to policyholders, emphasizes the management's viewpoint. However, it is the annual statements filed with the state authorities that contains carefully checked information, ready for the analyst's use. A cautious study of the assets and the liabilities is necessary for the life company must be approached through its balance sheet.

Next, the management to be evaluated include the directors, company officers, and department heads. This area exposes the comparatively low salary range for company executives, this being a regulated industry. Some fringe benefits are offered. Judgments based on qualitative characteristics should measure management's effectiveness.

The study then turns to external influences. Among these there is the potentially favorable future for an increased interest in common shares of life insurance companies. Yet, certain industry trends were discovered which could dampen or destroy the bright outlook for the industry. Therefore, the investor-analyst is warned to observe future patterns within the individual trends.

For the average investor, who may be interested in a capitalization of earnings formula, the study ended with this summary. Under 1955-1956 conditions, a starting capitalization value of 14 is adjusted by a plus 3 for the very favorable industry position. For primary companies, inherent strength rates a plus 2 to a plus 4; for secondary companies, inherent strength or weakness necessitates a plus 1 to a minus 1. The resultant capitalization factor can be adjusted for book value of shares or for potential stock dividends.

This final capitalization figure is multiplied by the average earnings per share to give a dollar intrinsic value. The earnings used should be the average earnings for the period 1945-1955, for they represent best a future cyclical period. At this point, the intrinsic value is compared to the current market price, to judge investment profitability. The investor made many judgments, based upon facts, and has convinced himself of the real worth of this life insurance company's common stock.

451 pages. \$5.75. Mic 56-3265

#### POSTWAR NORWEGIAN FINANCIAL PROBLEMS AND POLICIES: A STUDY OF THE MONETARY BANKING AND FOREIGN EXCHANGE PROBLEMS OF NORWAY DURING THE POSTWAR YEARS 1945-1949

(Publication No. 17,342)

Donald Eugene Syrvud, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Walter A. Morton

Postwar Norwegian financial problems were partly comparable with the general European financial disturbances but one peculiar Norwegian development created additional problems of significance to economic science. Norway followed several European nations in adopting a

"cheap money" approach to the postwar reconversion and reconstruction. However, the Norwegian experiment with a "cheap money" policy varied from those of other nations in that it became an integral part of a national economic planning program. Shortly after its election to power in November 1945, the Norwegian Labor Party initiated an experiment in economic planning which was the first of its kind in a democratic society.

Economic and political theorists have debated the question of the compatibility of economic regimentation with social and political democracy since the beginning of modern history; but the question remains with us. The evolution of industrial and financial capitalism with its attendant tragic cycles of inflation and depression has made it more essential than ever that some answer be provided. A thorough study of the first example of economic planning in a free society will certainly be of great value to all who are striving for the improvement of economic conditions while at the same time maintaining free institutions.

The basic aim of this study is to provide a description and analysis of the financial conditions, both internal and external, which facilitated the implementation of the Norwegian economic planning. In accomplishment of this aim the general method is to pose the financial problems as they occur, to describe the several advocated policies and finally, to evaluate the implemented policy in accordance with the prescribed economic objectives.

With considerable cooperation from every segment of the economy, the Norwegian government had substantial success in achieving a number of the economic objectives, viz., stable price level, full employment and an expanding economy. Despite inflationary pressures from at home and abroad, the price level remained relatively stable throughout the postwar period. The rate of investment was one of the very highest in the world, and this heavy rate of investment helped to assure the maintenance of full employment.

The primary financial means used in pursuing the economic objectives were stringent price, wage and foreign exchange controls and a subsidy system which rapidly grew to uncontrollable limits. Monetary and credit policy in the traditional sense played a minor role in the economy. Its primary function was merely to ensure the maintenance of low and stable interest rates. Few economists would disagree that direct controls were essential under the extraordinary conditions existing in postwar Norway. But direct controls should have been used as a complement to, not a substitute for, the more general monetary measures.

Two major questions form the core of this study: Firstly, how was the "cheap money" policy implemented and used to facilitate the national economic planning? Secondly, what were the consequences of the "cheap money" policy for the Norwegian economy? The most significant consequence of this policy was the creation of three pressure problems, viz., price, wage and exchange rate pressures. An upward pressure on the price and wage levels plagued the Norwegian authorities during the entire post-war period. A fundamental disequilibrium on Norway's balance of payments placed a strong pressure on the foreign exchange rates. Other effects of the "cheap money" policy were (1) to reduce the Bank of Norway from her prewar role of monetary manager to the passive position of bookkeeper for the government and (2) to detach the private banks from all semblance of monetary control.

273 pages. \$3.55. Mic 56-3266

## ECONOMICS, HISTORY

### THE INTERNATIONAL ROLE OF AMERICAN LABOR

(Publication No. 17,045)

Joseph Carwell, Ph.D.  
Columbia University, 1956

This dissertation traces the many forces, problems and conditions which contributed to the development of the American trade-union international orientation. This aspect of American labor activities has long been a neglected chapter in American labor history. Yet, since 1864, through the International Workingmen's Association of Marx, American labor has been concerned with the working conditions in other countries and has sought a common basis for cooperation in order to curb immigration. After American labor acquired a truly national character with the formation and growth of the American Federation of Labor, its relations with other national centers took two primary forms: (1) opposition to the internationalism of the working class as espoused by Marxists, designed to destroy nationalism; and (2) promotion of labor solidarity. It is against the background of persistent ideological conflicts that American labor evolved as a force in its own right until in recent years it became the dominant force in the international labor movement.

Because of the desire of American labor to play a role in international affairs, paralleling American leadership in the free world, the period 1945-55 embraces a whole series of problems and the labor politics of many countries in which the CIO and AFL played important roles. One of the most significant aspects in the development of an American labor international orientation was the struggle between the AFL and the CIO, particularly after the CIO joined the World Federation of Trade Unions (WFTU) with which the AFL refused to affiliate. To outflank the WFTU the AFL at first turned to Latin America and developed a rival hemispheric federation, the Interamerican Confederation of Latin American Labor (CIT) in opposition to the leftist Confederation of Latin American Labor (CTAL). On a more world-wide scale the AFL encouraged expansion of the International Trade Secretariats (ITS) which refused to join the WFUT until their status was clarified and their autonomy preserved. The inability by the WFTU to absorb the ITS constituted a real threat to the WFTU's right to act as sole spokesman for international labor. Even more remarkable was the extent to which the AFL and CIO was able to develop a community of free trade unions which in 1949 formed the International Confederation of Free Trade Unions (ICFTU).

A sizable portion of the dissertation is devoted to a discussion of the role of American labor in the success of the Marshall Plan and the formation of the European Recovery Program - Trade Union Advisory Committee (ERP-TUAC). The struggles within the WFTU and the new issues which arose in the ERP-TUAC are discussed in the light of American labor's desire to form a new international trade union body.

In the formation of the ICFTU, the sharpest debates took place between the British Trades Union Congress (TUC) and American labor, which proposed the formation of a large decentralized organization with regional bodies, so as to give prominence to the weak unions in underdeveloped

areas. The TUC favored a return to the kind of trade union international represented by the pre-war International Federation of Trade Unions (IFTU), in which the European trade unions were in a dominant position. The bitterness of this controversy is discussed in some detail, particularly with reference to the formation of the regional bodies in Asia, Africa and Latin America.

Once the ICFTU was formed and its regional branches organized, American labor sought to encourage the growth of unions in underdeveloped areas, often in connection with the aspirations of the nationalist movement in colonial countries. This has become, in the opinion of American labor, the most important role of the international labor movement in the present epoch. As a result, American labor had to break with its isolation from the mainstream of the international labor movement and has expanded the scope of its activities so as to embrace every aspect of the world of labor.

680 pages. \$8.60. Mic 56-3267

#### THE ST. LOUIS CENTRAL TRADES AND LABOR UNION, 1887-1945

(Publication No. 17,917)

Edwin James Forsythe, Ph.D.  
University of Missouri, 1956

Supervisor: Lewis E. Atherton

City centrals are directly affiliated with the American Federation of Labor, and admit only such locals which are in good standing with national or international unions affiliated with the American Federation of Labor. Although the negotiation of wages, hours and working conditions are in the main left to local and national unions, to be determined by collective bargaining, there are other important issues and duties that demand attention. At this point the auxiliary organizations become important. A city central is one of these organizations.

Until 1887, St. Louis had not less than four local central bodies--the Central Labor Union, the St. Louis Trades Assembly, the German Arbeiter-Verband and District Assembly No. 4 of the Noble Order of the Knights of Labor. Far-sighted members of the various city labor organizations realized the necessity of bringing the laboring groups together into one central body. Moreover, the American Federation of Labor urged a merging of the Trades Assembly and the Central Labor Union, and suggested a new organization to eliminate objectionable features.

The St. Louis Central Trades and Labor Union was chartered by the American Federation of Labor in September, 1887. The local leaders in this merger were from the Trades Assembly, the Central Labor Union and District Assembly No. 4 of the Knights of Labor. In the 1890's the German Arbeiter-Verband was dissolved and a number of its unions affiliated with the St. Louis Central Trades and Labor Union.

The St. Louis Central Trades placed organization and unification first among its immediate objectives and rendered assistance to striking unions.

During the early years of the American Federation of Labor, politics and political issues plagued the city centrals. In the St. Louis Central Trades and Labor Union, as

in other centrals, officials were removed from office during the early years for becoming too active in politics. This period of strife over politics and Socialism lasted until World War I.

In 1901, the jobs of Secretary and Organizer were combined into a full-time position. The Secretary Organizer, took charge of the union's administrative affairs, handled organizing activities, and was the chief officer of the union. The first Secretary Organizer, David Kreyling, remained out of politics and devoted his time instead to organization and assisting the city central's constituent unions.

The members of the St. Louis Central Trades followed the leadership of Kreyling in abstaining from third party movements prior to World War I and in the period following the War when some of the more radical city centrals became involved with independent labor parties.

Into the 1940's the St. Louis Central Trades did not participate in politics but adhered to the American Federation of Labor's policy of "rewarding one's friends and punishing one's enemies."

Kreyling was succeeded as Secretary Organizer in 1933 by his old friend and fellow cigarmaker, William Brandt. Brandt's ascension to the position of Secretary Organizer coincided with the passage of Section 7(a) of the National Industrial Recovery Act. Under his leadership the St. Louis central body assisted in the organization of new unions and the revival of many which had declined during the depression.

In the 1930's, Secretary Organizer Brandt and President Joseph J. Clark helped rid the local Bartenders and Motion Picture Operators' Unions of gangster leaders, despite threats of personal violence and with little assistance from the Executive Council of the American Federation of Labor.

Brandt was succeeded as Secretary Organizer in 1942 by John Rollings of the Barbers' Union. Under the leadership of Rollings, the St. Louis central body was active in defense activities during World War II and took a renewed interest in community affairs.

329 pages. \$4.25. Mic 56-3268

#### THE IMPACT OF HENRY GEORGE'S THEORIES ON AMERICAN CATHOLICS

(Publication No. 18,454)

James Jeremiah Green, Ph.D.  
University of Notre Dame, 1956

This study traces the spontaneous rise of Irish nationalism among American Catholics which resulted from a threatened famine in 1879-1880 in Ireland. This nationalistic sympathy included a strong criticism of economic conditions of the Irish peasantry based largely on landholding practices of the absentee landlords of Ireland. Through American Land Leagues having general remedial aims the suffering Irish received monetary and moral support in their struggle to better their conditions. Differences over specific remedies -- Michael Davitt's nationalization scheme and Henry George's theories favoring radical solutions -- shattered the unanimity of the agitation. The radical land reforms embodied in Gladstone's Land Act of 1881 removed some of the causes of

the agitation as well. The Reverend Edward McGlynn, pastor of St. Stephen's in New York, championed the radical faction of Irish nationalists following Patrick Ford's advanced position. Ford through the Irish World dramatized the Irish struggle as a beginning of a general labor movement for economic "emancipation" of workingmen. Henry George's very similar position, advocated in his books Progress and Poverty (1879) and The Irish Land Question (1881), called for a single tax on land equivalent to the unearned increment which he claimed was created by the community, and belonged to it in justice. Father McGlynn's acceptance of George's theories, which many Catholics believed were subversive to the principle of private property, caused a controversy in the American Church.

The Central Labor Union of New York formed to express sympathy for the struggling Irish and to push for labor reforms in America, nominated Henry George to stand as labor's candidate for mayor of New York in 1886 accepting a single tax and labor platform. The political power of the George party in 1886, backed by Father McGlynn, Patrick Ford and numerous rank and file Catholic workingmen alarmed the public and particularly Archbishop Michael A. Corrigan and Bishop Bernard McQuaid. Corrigan suspended McGlynn for his political activities and "socialistic" Georgism. Formation of the United Labor Party and the Anti-Poverty Society by the Georgists to continue the agitation claimed McGlynn's attention and he was excommunicated in 1887 for technical disobedience. McGlynn's friends and followers claimed his rights as an American citizen were violated while the majority of disputants reexamined and defended the Catholic stand on private property in land. Many sought other social reforms to solve the social question while retaining the principle of private land ownership. They called for ethical reforms in industrial economy and stressed the Thomistic interpretation of ownership which condemned abuses while supporting the principle. Thus American Catholics anticipated the principles forwarded by Pope Leo XIII in Rerum Novarum (1891). Archbishop Corrigan, however, who had recommended condemnation of George's theories, interpreted the Encyclical as a public doctrinal pronouncement against Georgism, renewing unwittingly the controversy with the Georgists. The restoration of Father McGlynn and a more catholic interpretation of Rerum Novarum advanced by Bishop John J. Keane and backed by Cardinal James Gibbons and Archbishop John Ireland pointed to a more realistic resolution of differences. Many prelates of the American hierarchy had protested any condemnation of George's writings as untimely and unwarranted. Some who studied George's ideas recognized them as reformist rather than subversive and approved in general the application of ethical principles to social problems. The few Catholic Georgists, particularly the Reverend Louis A. Lambert and Edward Osgood Brown in the 1890's, maintained their right to accept and proclaim the single tax as harmonious with Rerum Novarum. The interest of most Catholics, however, turned to other matters and more practical specific remedies for the solution of social, industrial, and labor problems.

377 pages. \$4.85. Mic 56-3269

## HISTORY OF THE UNIVERSITY BOOK STORE 1900-1955

(Publication No. 18,502)

Justin Gooderl Longenecker, D.B.A.  
University of Washington, 1956

The University Book Store, Seattle, Washington, was launched on borrowed capital by students of the University of Washington in 1900. Between 1900 and 1955, the Store moved from the campus to a nearby shopping district, expanded its lines of merchandise, purchased a physical plant, and grew to a net worth of more than three-fourths million dollars. With sales of one and one-half million dollars in 1955, the University Book Store was the second largest college store in the United States. Textbooks and student supplies account for almost one-half of the Store's total sales, but other products sold by the Store include clothing, photographic equipment, trade books, typewriters, sporting goods, records, linens, leather goods, and gift-wares.

Although the Store operates like a cooperative in distributing profits to student customers, it has been organized, since 1932, as a corporation under the laws of the State of Washington. All stock of the Store is held by the Associated Students of the University of Washington. The Store's primary mission is service to students. In accomplishing this objective, however, management has found itself the focal point of various demands for service, pressures, conflicting interests, and efforts to control. The Store is controlled by the Associated Students through the Store's Board of Directors, but Store policy and plans are also subject to review by the University Administration and Board of Regents. Other groups with special interests in the Store's operations and service include student purchasers, competitors, community customers, civic groups, and the Government. Throughout the history of the Store, management has resolved these interests in such a way as to provide effective and economical service to students.

The emphasis of this history is upon the administration of the Store--i.e. planning, organizing, and controlling--within this framework of varied and frequently conflicting interests. Special attention was devoted to such significant factors in the Store's development as enrollment growth of the University of Washington, favorable location, special appeal to students because of student ownership, corporate form of organization, and quality of Directors and management personnel.

Major problems of management which are examined in this study include difficulties in student relations; physical limitations; appointment and tenure provisions affecting the Board of Directors; and questions concerning prices, patronage refunds, and profit distribution. The contribution and effectiveness of the Store were examined in a number of ways. The Store's achievements were first measured against the Store's original objectives. Student opinion concerning quality of service to customers was also considered. Other measures of efficiency of operation included comparisons with operating and profit ratios of college stores and other types of stores, analysis of the trend of textbook sales, and evaluation of the Store's budgetary program.

410 pages. \$5.25. Mic 56-3270

**CANAL CYCLES, 1834-1861: PUBLIC CONSTRUCTION EXPERIENCE IN NEW YORK, PENNSYLVANIA AND OHIO**

(Publication No. 19,255)

Harvey Hirst Segal, Ph.D.  
Columbia University, 1956

This is a quantitative study of canal construction in New York, Pennsylvania and Ohio, 1834-1861, and its relationship to general economic activity. In order to analyze the variations of canal construction activity, time-series of annual data relating to expenditures for new canal construction were assembled, and estimates of the value of new work completed were made for those years during which payments to contractors were delayed.

Between 1835 and 1836 the three states embarked upon extensive construction programs designed to enlarge and improve the existing public canal (and railroad) systems that were ultimately completed at a cost of more than \$75,000,000. The concentration or clustering of new undertakings in that period is attributable principally to the ease with which long-term loans could be obtained in the London money markets as well as to a spirit of optimism that was engendered by the domestic prosperity. Construction activity in the three states was expanded contracyclically during the business-cycle contraction of 1836-1838. (The reference dates are from the business-cycle chronology of the National Bureau of Economic Research, Inc.) It continued to rise until 1840 in Pennsylvania and Ohio, and until 1841 in New York, thus lagging the upper cyclical point of 1839.

During the cyclical contraction of 1839-1843 the flow of British long-term funds to the United States was drastically reduced, thus precipitating crises in the financial affairs of the three states which had been relying almost exclusively upon foreign loans for the completion of their construction programs. Work on the canals of New York and Pennsylvania was suspended in the Spring of 1842 after an unsuccessful attempt in the latter State to finance construction operations through the issuance of banknotes that were redeemable in depreciated State bonds. Despite enormous difficulties, Ohio managed to continue work on her canals until their completion in 1845 by selling bonds at large discounts, issuing post-dated checks upon the treasury and transferring bonds directly to construction contractors.

In the middle 1840's construction activity was revived on the public systems of New York and Pennsylvania. Unlike the earlier period, the states were almost entirely freed from their dependence upon the London money market and they financed construction operations largely from tax revenues and the proceeds of domestic loans. Activities in both States were continued without serious interruptions until the last projects were completed.

Comparison of canal expenditures with the available estimates of the value of urban construction and that of the railroads of Pennsylvania and New York indicates that canal construction activity was a relatively important component of net capital formation, especially during the period 1836-1842. Although the relationship between canal construction activity and the volume of employment was recognized, there is no evidence in the official documents that the canal projects were initiated or substantially prolonged for the purpose of relieving the unemployed.

The time-series data reveal the presence of two long

cycles of total canal construction activity whose timing is largely independent of business cycles. The upswing of the first cycle commenced in 1836; it reached a peak in 1841, two years after the business-cycle turning point, and a trough in 1846. A second wave of construction activity began in 1846, reached a peak in 1856 and a trough in 1861. The long canal cycles are attributable to the cessation of the flow of British capital funds after 1839, which interrupted the construction programs, as well as to the fact that canal projects require construction periods whose length exceeds the duration of business cycles.

329 pages. \$4.25. Mic 56-3271

**ECONOMICS, THEORY**

**AN ECONOMIC THEORY OF GOVERNMENT DECISION-MAKING IN A DEMOCRACY**

(Publication No. 17,713)

Anthony Downs, Ph.D.  
Stanford University, 1956

Economic theorists conceive of decision-making as a process in which consumers and producers rationally maximize utility and profits respectively, but they have advanced no similarly fruitful rule to describe government decision-making. This study posits that the object of the government in a democracy -- i.e., of the governing party -- is to seek re-election by rationally maximizing votes. This hypothesis is explored under conditions of certainty and uncertainty in a three-stage model.

All three stages assume that (1) two or more parties compete for power in periodic elections, (2) the party winning the most votes becomes the government, (3) every citizen has one and only one vote, and (4) the governing party has unlimited powers economically but cannot interfere politically with other parties or basic civil rights.

The hypothesis states that parties act solely for the power, prestige, and income received from holding office. This premise is shown to be a corollary of the universal axiom in economic theory about the relation of private motives to social function in the division of labor.

To illustrate the basic logic of political decision-making, the same "perfect certainty" and individual rationality are assumed in the preliminary stage as in most general equilibrium models. The rational citizen decides how to vote by comparing the utility income he received from the incumbent government with the incomes he believes he would have received if opposition parties had been in power. The rational government does whatever pleases a majority of citizens, but opposition parties can sometimes defeat it with a coalition of minorities or when no majority consensus exists. However, the premise of "perfect certainty" leads to contradictions because democracy probably could not function in a "certain" world.

Therefore uncertainty is introduced and its impact on the above decision-making processes examined. Because not all voters are sure which party to support, political influence appears, and some voters become more influential than others. Also, government must rely on

intermediaries -- whether officials or lobbyists -- to discover people's desires. These disparities of political weight offset the equality of franchise to some extent.

Political ideologies are explained as weapons employed by the various parties in their struggle for votes. Because citizens behave rationally, every party must maintain a certain degree of integrity and consistency in its behavior. An ideological scale is developed from Hotelling's spatial-competition model, and the conditions under which democracy leads to two parties, many parties, or dictatorship are explored. A revision in the model allows the difficulties of rational behavior under coalition governments to be demonstrated.

The impact of a vote-maximizing government upon the marginal allocation processes of individuals and firms is analyzed. It is shown that such a government inevitably blocks attainment of a Paretian optimum position even under conditions of relative certainty. It also tends to redistribute income from rich to poor citizens.

The third stage concentrates attention upon the cost of information. Since in all decision-making only a few data can be selected from the many that might be relevant, how many should *homo politicus* acquire? The rational answer to this question is set forth and the following conclusions proved: (1) in a rational democracy not all citizens are equally well-informed politically, (2) for many, acquiring any political information *per se* is irrational, and (3) uncertainty inevitably creates a political bias against low-income citizens and against consumers *qua* consumers. The rationality of abstention from voting is also explored.

Finally, several testable hypotheses which this theory leads to are described and possible testing methods set forth.

356 pages. \$4.55. Mic 56-3272

rate of investment in fixed capital, they contend, are principally a function of real factors affecting the stock of profitable investment opportunities.

A theory asserting the importance of underlying long-term investment opportunities in controlling the rate of fixed capital investment must assume that errors in appraising the stock of investment outlets create a response mechanism in the economy which signals an inappropriate rate of investment. This assumption is in the familiar Marshallian tradition, in which expected and equilibrium values of the significant variables are believed to converge in successive approximations. Applied to investments which are basically nonduplicational in character, this assumption is scarcely tenable in a world of dynamic change. The costs and revenues relevant to such investment decisions are known, at best, only approximately; the data from which such cost and revenue estimates are derived, moreover, are not spontaneously generated in the market. The concept of an objective stock of opportunities for adopting unfamiliar factor combinations, for establishing new production functions, and for altering the composition of final output defies quantification by the independent observer, and has but limited predictive significance for the economist.

Duplicational investment decisions in an individual firm may be based on historical profit margins. Under *ceteris paribus* assumptions, changes in profit margins indicate the availability of investment outlets. In a world of imperfect knowledge, however, the profitability of an investment expenditure is known with certainty only when the initial cost of the assets is compared with the discounted gross receipts accruing to the assets over their entire economic life. Overinvestment or underinvestment in durable assets relative to investment opportunities is discoverable only with a time lag which is, in many cases, longer than the major cycle itself.

In the aggregate duplicational investment decisions do not necessarily create a response mechanism indicating the presence or absence of further investment opportunities, since aggregative investment decisions contain a circular self-justifying character. A fall in the rate of investment reduces profit margins, which may prompt a further reduction in capital outlay, although investment opportunities are unchanged. A rise in the rate of investment necessarily reduces profit margins, appropriately indicating an investment saturation, only when resource scarcities prevent output from growing at a sufficiently rapid rate.

These arguments cast doubt on the hypothesis that the rate of fixed capital investment is closely controlled by the stock of long-term investment opportunities. The possibility is then opened that disturbances present in inventory cycles may affect fixed capital investment through their impact on long-run expectations.

185 pages. \$2.45. Mic 56-3273

#### LONG-TERM INVESTMENT OPPORTUNITIES AND THE MAJOR-MINOR CYCLE DICHOTOMY

(Publication No. 17,951)

Lyle Elden Gramley, Ph.D.  
Indiana University, 1956

The analytical usefulness of models which distinguish between major and minor cycles rests upon their ability to furnish guides for prediction. The existence of such guides, in turn, depends upon the validity of the assumption that different types of cycles have relatively unique causal forces which are observable *ex ante*. Professors Hansen and Gordon, who believe that a significant distinction can be made between major and minor cycles, argue that major cycles reflect changes in the stock of long-term investment opportunities, while only minor (inventory) cycles occur when that stock is unaltered. Changes in the

## EDUCATION

### EDUCATION, GENERAL

#### RELATION OF INDUSTRIAL ARTS INSTRUCTION TO PRACTICES FOLLOWED BY ADULTS IN THE SELECTION, CARE, AND USE OF TOOLS

(Publication No. 17,900)

Chester Boyd Ainsworth, Ed.D.  
University of Missouri, 1956

Major Adviser: Dr. H. H. London

#### Purpose of Study

To ascertain practices followed by adults in the selection and care of common hand and power tools and their use in and around the home, and to learn whether or not there was a significant difference between practices of adults who have and who have not had industrial arts instruction in the secondary schools.

#### Method of Research

Data for the study were obtained from an interview schedule used in a series of one hundred personal interviews conducted in the homes of the participating individuals. These were the 1935 through 1945 male graduates of six Central Missouri high schools, who had established homes in these communities. Interviewees had had no shop instruction beyond the secondary schools and worked in occupations which did not involve the sale or the use of tools. Participants were divided into two groups: Group A was composed of adults having had two or more years of industrial arts instruction in the secondary schools; Group B was composed of adults having had no industrial arts instruction in secondary schools.

#### Summary

1. Interviewees with industrial arts instruction expressed significantly more interest in working with tools than those lacking such instruction.
2. There was found to be no significant difference, on the basis of the criteria used, between the groups in the selection of hand and power tools.
3. Interviewees with industrial arts instruction owned significantly more standard brand hand tools than those lacking such instruction.
4. There was found to be no significant difference between the groups with respect to the number of non-standard brand hand tools owned, or the number of standard and non-standard brand power tools owned.
5. Approximately the same number in each group had a home work shop.
6. No significant difference was found between groups with respect to practices followed in storing tools.
7. Significantly better practices were followed by those with industrial arts instruction in the cleaning of tools than were followed by those lacking such instruction.

8. There was found to be no significant difference between the two groups with respect to practices followed in sharpening, inspecting, or performing needed repairs on tools possessed.

9. There was no significant difference between the groups with respect to jobs done with tools in and around the home involving repair, maintenance, new construction, and home improvement activities.

10. Those with industrial arts instruction reported doing significantly more jobs involving lawn mower and automobile maintenance than those lacking such instruction.

#### Conclusions

1. Adults with industrial arts instruction have a greater interest in working with tools and buy more good tools than those without such instruction.
2. The criteria used by adults in the selection of tools seems to be affected very little, if any, by industrial arts instruction.
3. Adults with industrial arts instruction usually follow better practices in keeping tools clean than those without such instruction.
4. The influence of industrial arts instruction on practices of adults involving sharpening, maintenance, and repair of tools possessed appears to be slight.
5. The influence of industrial arts instruction on the practices of adults involving the use of tools for repair, maintenance, and new construction on the home and home furnishings appears to be only moderate.
6. The increasing number of relatively young home owners, who are attempting many do-it-yourself projects, and who have little or no instruction in the use of tools, are in need of adult classes involving instruction of this type.

145 pages. \$1.95. Mic 56-3274

### AN INVESTIGATION OF FACTORS TENDING TO FACILITATE OR TO OBSTRUCT PROGRESS IN LOCAL ACTION RESEARCH IN PUBLIC SCHOOLS

(Publication No. 19,351)

Christine Viola Brannan, Ed.D.  
University of Houston, 1956

The investigation was undertaken to discover how the conduct of action research projects that had satisfactorily culminated or were ongoing differed from that of projects that came to an early standstill, and what administrators may do to create in their schools a climate favoring action research.

The activity known as action research was found not to be altogether new, although the term has entered educational literature recently. It is nearly synonymous with service research, applied research, cooperative research, and operations research.

Among advantages of action research are its treatment of a problem in its setting rather than through an unrealistic effort to isolate a single variable, its applicability to local situations, and the immediacy of its benefits.

The following was accepted as a working definition: Action research is an undertaking by teachers to collaborate in an experimental attack on a shared problem with a view to establishing through appraisal of trials an improved solution which can be incorporated successfully into routine action in the local context.

Seventy-eight such projects were identified in thirty-one Texas school districts from survey information secured from participating teachers, administrators, and consultants. Their descriptions were analyzed and compared with reports of teachers who had failed to carry out needed projects.

Completed or ongoing projects studied included preparation for curriculum building, curriculum studies, preparation of materials to implement curricula, programs for atypical groups, studies of methods in skill subjects, and problems of administration, guidance, or public relations.

Descriptions were given, frequently in the words of group participants, of reported influences of administrative attitudes and stability; of qualifications, attitudes, and relationships of group participants; of consultants; of appropriateness of problems; and of such physical aspects as time and compensation, places for group work, clerical assistance, and availability of supplies and equipment.

The specific factors facilitating progress in action research that were found recurrently in the reports studied were summarized in the form of an inventory or checklist suggested for application by school personnel in assessing readiness of a school system for action research. This suggestion stemmed from the observation that the factors listed were each susceptible in some degree to modification or improvement by school administrators or group members.

121 pages. \$1.65. Mic 56-3275

#### **AN ANALYSIS OF CERTAIN COMPONENTS OF MATHEMATICAL ABILITY, AND AN ATTEMPT TO PREDICT MATHEMATICAL ACHIEVEMENT IN A SPECIFIC SITUATION**

(Publication No. 17,945)

Ralph H Coleman, Ph.D.  
Indiana University, 1956

Chairman: A. Stafford Clayton

This study combines the results of related and original research to test hypotheses formulated concerning components of mathematical ability and prognosis of success in college mathematics. The related research dealt with high school as well as college students; the original research dealt with college students at Evansville College.

In this study emphasis is placed on the deductive and inferential nature of mathematics. By mathematical ability is meant the ability to arrive at conclusions about the elements by accepted logical processes. The level of mathematical ability is relative and is a function of the group in which the comparison is made.

If, then, reasoning to conclusions is the heart of the

mathematical process, a student who excels at drawing conclusions might be expected to excel also in his mathematics classes. A test was designed to check this hypothesis. This test consisted of three subtests, Deductive, Inductive, and Arithmetic Reasoning, which involved reasoning to correct conclusions; one subtest, Spatial Relationships, which involved ability to visualize objects in space; and one subtest, Computation, which involved computational skill. As this test was planned to be used with students with widely varying mathematical backgrounds, an attempt was made to include items that were as independent as possible of past training in mathematics. The working time on the test was 47 minutes. This test is referred to in the study as the Designed Test.

The Designed Test was administered to 130 students at Evansville College. A reliability coefficient of .88 was arrived at by using the split-halves method and the Spearman-Brown correction formula. Scores on the test were correlated by subtests and by totals with the actual end-of-quarter grades and with the end-of-quarter grades corrected for differential efforts on the part of the students. These corrected grades were arrived at by utilizing both the students' and the instructors' opinions concerning the students' relative efforts. Case studies of two students whose success in college mathematics seemed most out of line with their ability were discussed.

The original research also included a study of the grades of 102 students as they progressed through the two-year sequence of undergraduate mathematics.

The related and original research were investigated for evidence tending to support or deny the formulated hypotheses. It was concluded that the data supported to varying degrees each of the following hypotheses:

1. Computational ability is an ability distinct from and only remotely related to mathematical ability.
2. Mathematical ability is closely akin to ability in deductive reasoning.
3. Ability to see spatial relationships is helpful in a limited area in mathematics.
4. A good memory is not a necessary ingredient of mathematical ability.
5. Personality traits of the students greatly affect their success in college mathematics courses.
6. Grades in mathematics courses (as well as in other courses) are affected by students' goals not necessarily commensurate with their abilities.
7. Individuals lacking in mathematical ability can be completely baffled by concepts elementary to the "mathematically gifted."
8. Tests can rather reliably predict which students will not excel in college mathematics courses.
9. While the mathematical ability possessed by an individual remains rather constant, varying efforts and different backgrounds of individuals for various topics in mathematics lead to differential successes.
10. Degrees of mathematical ability are differentiated both by the accuracy with which inferences are made and by the depth of understanding of mathematical concepts.

120 pages. \$1.50. Mic 56-3276

**A PLAN OF DEVELOPMENT FOR A COMMUNITY COLLEGE IN MOSES LAKE, WASHINGTON**

(Publication No. 18,495)

Winfield Steinner Fountain, Ed.D.  
University of Washington, 1956

Supervisor: Dr. George D. Strayer, Jr.

**Purposes of the Study**

Moses Lake was the largest city in the rapidly developing Central Columbia Basin in the State of Washington. Its 1956 population of 11,000 was less than half the school district population of 25,000. Of this latter number, 5,000 were school age children, a figure that was expected to grow to over 13,000 by 1960.

The post-high school training and educational needs were extensive because of the newness of the agricultural, industrial and business enterprises. Families were large and many high school graduates were needed at home to help with the cultivation of the irrigated farm units.

Over seventy miles separated Moses Lake and the nearest technical or academic institutions of higher learning. The cost in time and money to attend one of these schools was prohibitive for many families.

It was the thesis of this study that the establishment of a community college provided a sound solution to the peculiar training requirements and post-high school educational needs of the Moses Lake area.

The primary purpose of this study was to determine the advisability of establishing a community college as an extension of a local public school system. This required the obtaining of the necessary background information, authoritative opinion and guidance, and a measurement of local need and enthusiasm for a community college.

Secondly, it was anticipated that the research necessary to obtain this information would also divulge inherent problems, costs and requirements for setting up a community college educational program in the State of Washington.

Thirdly, it was believed that this organization of a body of recent and usable information would be of assistance to students of the community college movement and to school personnel who were contemplating the establishment of a similar institution.

**Methods, Procedures and Results**

The historical method of research was employed to follow the transition of the junior college from an institution that was strictly academic to one that embodied college-parallel, vocational-terminal and adult education programs. Accompanying this transition were the development of establishment criteria, evaluation standards, improvements in financing and identification as a part of the community and local school system.

The normative survey method, which utilized a questionnaire, was employed with the administrators of twenty two selected community junior colleges in the states of Washington, Idaho, Oregon and California. Their responses indicated, among many other things, that the beginning enrollment of the new community college should be between 150 and 200 full time students and should have an operating budget of approximately \$100,000.

The use of a questionnaire device also determined that

579 out of a total of 725 Central Columbia Basin high school junior and senior respondents were planning post-high school education and training, and that 322 of this number would attend a community college in Moses Lake.

The normative survey method utilizing the personal interview indicated that 76.7 per cent of the 757 school district patrons polled were in favor of the establishment of a community college, even though extra cost was expected. A second personal interview poll indicated that forty two employers out of a total of forty six respondents employing ten or more people were in favor of the community college and that forty three of these employers would hire community college trained personnel.

A review of readiness factors indicated the presence of apparent potential, general interest, expressed need, and community leadership which were essential to the establishment of a community college. An existing night school enrollment in excess of 600 individuals emphasized this readiness.

**Recommendations**

The information that was obtained indicated the feasibility of planning a community college developmental program in conjunction with the school staff, the board of school directors, community committees and state and senior college authorities, which would pass through three sequential phases:

1. The 1956-1957 expansion of extended secondary, vocational, high school credit and general interest educational programs in the adult night school.
2. The establishment of an evening community college program for the years, 1957-1960, which would operate between the hours of 4 and 10 P.M., which would utilize the existing high school building, and which would be largely self-supporting.
3. The establishment in 1960 of a regular fulltime community college program, which would have its own campus and staff, and would be organized to provide a comprehensive offering in college-parallel, vocational-terminal and adult education.

435 pages. \$5.55. Mic 56-3277

**IMPROVING PREPARATION FOR COLLEGE WRITING:  
A SURVEY OF COLLEGE STUDENTS AND COLLEGE  
ENGLISH INSTRUCTORS TO DETERMINE WHAT TO  
EMPHASIZE IN COLLEGE-PREPARED WRITING**

(Publication No. 17,658)

William Lauroesch, Ed.D.  
New York University, 1956

The purpose of this study was to gather, interpret, and evaluate information and opinions from college students and college instructors in English composition in order to determine what to emphasize in a high-school writing program for students who plan to attend college.

In view of the historic trend toward self-determination, secondary schools face a need and obligation to find means for gaining better insight into their role in the joint and continuous school-college responsibility for English language instruction. Toward this end a questionnaire survey was conducted in which four classes of Suffern High School

(Suffern, New York) graduates who had gone to college were asked for information about the skills they needed for their college work and their judgment of what is necessary in a high-school preparation for college writing. Returns were validated and enlarged upon through interviews conducted with one-third of the respondents.

In interviews with sixteen college English composition instructors, additional data were gathered concerning the most widespread writing deficiencies among entering freshmen and the major areas for emphasis in high-school preparation for college, according to the judgment of those interviewed. Data collected by these means were tabulated, compared with disclosures of recent literature, and analyzed to determine their indicative value for the improvement of preparation for college writing at Suffern High School.

Three major problems came to light as a result of the data analysis: (1) It was apparent that there is widespread misunderstanding of the term "grammar" among college students. This invalidated much of the data relevant to that English skill. (2) College students' self-evaluation in certain composition skills presented an unbalanced picture, suggesting lack of sequence and continuity in the Suffern High School English program. (3) An acknowledged weakness in the skill of editing was coupled with apparent failure of the school to arouse pupils to an awareness of the importance of English in college work. Close attention to disclosures of literature pertinent to these problems clarified and enlarged upon the issues with which these problems are concerned. Citations from the literature furnished to the recommendations of this study concrete, tested practices and procedures for the alleviation of the difficulties uncovered by the data.

Findings derived from the questionnaire survey, interviews, and the literature were the bases for ten conclusions: (1) That increasing writing activity is the most important single step toward improving writing; (2) that emphasis on writing skills is proper in college-preparatory English; (3) that the long documented paper is a worthy college-preparatory writing activity; (4) that homogeneous grouping according to ability and achievement is desirable in English classes; (5) that provision within the teacher's working day for planning, pupil conferences, and theme reading is an asset to an English program; (6) that additional emphasis on instruction in the writing of effective sentences is Suffern High School's most critical need; (7) that a need for long-range cooperative planning to improve sequence and continuity of instruction is apparent; (8) that continuous articulation of all levels within the local system and between school and college underlies an effective English program; (9) that a knowledge of grammar is necessary for college; (10) that there is duplication of library instruction on school and college levels.

Recommendations based on these conclusions were for administrative action, planning and action by the entire English staff, and improvement and extension of the twelfth-grade college-preparatory English program.

265 pages. \$3.45. Mic 56-3278

## AN INVENTORY OF PERMANENT CUMULATIVE PUPIL RECORD SYSTEMS IN SELECTED MISSOURI SCHOOL DISTRICTS

(Publication No. 18,585)

Arthur John Looby, Ed.D.  
University of Missouri, 1956

Supervisors: W. R. Carter and W. W. Carpenter

**Purpose:** To determine the status and extent of permanent, cumulative pupil record systems in selected Missouri school districts and to determine whether or not there were differences between elementary and high school records; and, between records used in small and large districts.

**Method of Research:** A record inventory form was constructed as the result of a preliminary survey and a review of the literature and sent to the superintendents of a selected group of Missouri school districts.

### Conclusions:

1. The status and extent of cumulative records in Missouri's public schools had improved considerably, but it could not be considered satisfactory.
2. The cumulative record form was accepted as a needed record form for currently enrolled elementary and high school pupils. It was also accepted as the form to be retained for all school leavers.
3. All of the districts which cooperated with the study did not have a form titled as cumulative, but all of the persons who completed inventories had a clear conception that the form used in their districts was a permanent, cumulative, and individual pupil record.
4. Most of the persons who cooperated with the study evidenced an awareness of the value and necessity for adequate pupil records.
5. Most of the persons who cooperated with the study evidenced knowledge about cumulative record systems, but did seem to realize that such systems entailed other aspects such as providing for usage; policies for item recording, error detection, and correction; and, periodic inventories.
6. There was confusion as to whether the cumulative form was primarily meant for use while the pupil was enrolled in school or whether it was meant to be a form for archive purposes.
7. Commercial record forms apparently satisfied the recognized needs of most districts.
8. There appeared to be no important differences between cumulative forms which were constructed locally and those which were purchased commercially.
9. A considerable degree of record and item uniformity had been achieved, but professional training, direction, and assistance were needed.
10. There was little understanding of the relative value of the various types of data which could or should be recorded.
11. There appeared to be very little exchange of information about transfer pupils between schools and districts.
12. There was only a small degree of relationship between the items recorded and the generally accepted functions of the school personnel who recorded them.

13. Most pupil record systems were adequate to answer simple demands made upon them by persons within and without the schools.

14. School personnel were aware of the advantages of state uniform recording, but were not aware of the advantages of national uniform recording.

15. Level of organization and size of enrollment did not greatly affect the cumulative record systems used.

**Recommendations:**

1. A course in pupil record management should be required in the professional preparation of teachers and administrators.

2. A standard record form should be required and supplied by the State Department of Education for each enrolled elementary and high school pupil in Missouri or certain basic items of pupil identification, school progress, and psychological information should be required regardless of forms used.

3. The Missouri State Department of Education should organize a section in the Division of Instruction to:

- a. Assume leadership in the establishment, management, and improvement of adequate school record systems.
- b. Serve as a clearing house for cumulative forms of children who transfer from school to school.
- c. Serve as a central file for cumulative forms of children who leave school.

4. The cumulative record form should be considered a vital statistic form to be safeguarded and preserved and other forms should be developed for day to day use by school personnel. 223 pages. \$2.90. Mic 56-3279

**STATE INSTRUCTIONAL MATERIALS IN INDUSTRIAL ARTS: THEIR STATUS, CONTENT, PREPARATION AND USE**

(Publication No. 17,905)

James Herbert Mahoney, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. H. H. London

**Purpose of Study:** The purpose of the study was to ascertain the status, content, preparation and use of industrial arts instructional materials prepared under the leadership of state departments of education.

**Method of Research:** Data for the study were obtained through an analysis of state prepared industrial arts publications, through letters and information forms from representatives of the 48 state departments of education, and through information forms returned by Missouri industrial arts teachers.

**Summary and Conclusions:**

- (1) State departments of education anticipate a continuing need for industrial arts handbooks, as two-thirds of the states plan to prepare them in the future in comparison to one-half that have done so in the past.

(2) Resulting from the prevailing philosophy of education which advocates local autonomy in curriculum development, state departments of education in the past have favored general publications over course outlines. However, at present, as indicated by representatives of state school agencies, course outlines are slightly favored.

(3) Since teachers expressed a need for both the general topics found in handbooks and topics which relate directly to specific courses, it seems that state departments of education should attempt to prepare a general publication, or handbook, and a series of course outlines which supplement their handbook and relate directly to specific courses.

(4) At present there is a slight trend toward referring to instructional materials which are defined in this study as handbooks and course outlines as "instructional guides."

(5) State instructional materials in industrial arts are prepared for the purpose of satisfying recognized needs, as legal or administrative regulations are rarely responsible for their preparation.

(6) A major factor which limits the preparation of state industrial arts materials is inadequate supervision at the state level.

(7) Although no two states provide identical topics in their publications, there is considerable uniformity as several of the basic topics are included in 90 per cent or more of the states' publications.

(8) State departments of education should utilize every sound means available in selecting the material that goes into their state industrial arts publication under the headings, "Things Students Should be Able to Do" and "Things Students Should Know," since these sections are used more consistently and are more highly valued by teachers and, therefore, tend to determine the content of local courses.

(9) Although topics relating to instructional aids are a part of industrial arts publications, there has been little attempt to organize these aids and relate them to particular units of subject matter.

(10) Unified supervision of industrial arts and vocational-industrial education at the state level tends to benefit industrial arts programs, as states with this type of supervision more often prepare industrial arts publications.

(11) Teachers tend to use locally prepared instructional materials instead of the state publications in schools and communities where such materials have been developed.

(12) Teachers tend to make greater use of those topics which can be applied most directly to the problems of routine classroom instruction.

(13) Generally speaking, teachers with four or more years of teaching experience and those with Master's degrees tend to value and use state prepared instructional materials to a greater extent than do beginning teachers and those with Bachelor's degrees only.

181 pages. \$2.40. Mic 56-3280

**AN INVESTIGATION OF THE DIFFERENCES IN LANGUAGE DEVELOPMENT BETWEEN ELEMENTARY SCHOOL BOYS AND GIRLS OF THE SAME CHRONOLOGICAL AGE**

(Publication No. 18,506)

John Lyle Moody, Ed.D.  
University of Washington, 1956

Supervisor: Henry R. Fea, Ph.D.

If individual differences are to be respected in instruction, the differences in language development between boys and girls must be determined and understood. The purpose for the study was threefold: (1) to analyze the data available in the literature on the subject of differences; (2) to analyze the backgrounds of the pupils studied; and (3) to note implications and make recommendations for further studies.

The limitations of the study were: (1) the community selected was homogeneous and stable; (2) the fifth grade classes of only one community were investigated; (3) only English speaking Caucasians were considered; (4) only factors believed to be closely associated with language development were assessed; and (5) the measuring instruments used by the school were accepted as valid.

Studies pertaining to individual differences, in general, were considered under the headings of physical growth, mental growth, and social-emotional development. Studies which could be considered as primarily in the field of language development were considered under the heading of language growth.

The data were collected on the 114 fifth grade pupils of an elementary school in Seattle, Washington. Information was taken from the permanent record cards and from interviews with students, parents, and teachers; this material included teacher-assigned grades, standardized test scores, and pertinent social data.

A number of students were selected for intensified study by groups. After analysis of teacher-assigned grades and reference to the Franks thesis<sup>1</sup> which suggested that girls with lower IQ's than boys still had higher grade averages, two comparisons were made: (1) the low achieving girls compared with the medium achieving boys, and (2) the medium achieving girls compared with the high achieving boys.

#### Conclusions

On the basis of the data obtained, the following conclusions were drawn:

1. There are differences in average language development between boys and girls of the same chronological age.
2. The physical development of the students was not a factor.
3. The economic status of the family was not a consideration.
4. The mental factor was a definite consideration, but as one of the limitations of the study was the measuring instruments used, the validity of the standardized test differences is questionable.
5. The study seemed to indicate that attendance may be a factor in language development.
6. The relation between level of language achievement and kindergarten attendance appears to be negligible in this study.

7. The relationship between attendance and reading in the medium-high group appeared to be negligible.

8. The boys did not achieve higher than girls in science and arithmetic as usually reported.

9. The low achievers in several instances came from families with the mother working away from home.

10. The study seemed to indicate that the only child and the youngest or oldest child in the family has a good chance of being among the low achievers.

11. The social activity outside of school may have a relationship to low achievement.

12. The parent-child relationships appear to be an important factor in language development.

#### Recommendations

##### Recommendations for further study:

1. What is the effect of the mother working away from home on the child's achievement in language arts?
2. What are the effects of ordinal position on language development?
3. What are the validity and reliability of standard measuring instruments in the language arts?
4. What are the differences in pupil achievement at the elementary level when the sex of the teacher is the variable in the investigation?
5. What changes do male teachers believe should be made in the elementary grade curricula?
6. What are the effects of out of school social activities on achievement in language arts?

102 pages. \$1.50. Mic 56-3281

1. Kermit Dean Franks, "A Study of the Success of High School Students in Language Arts, Foreign Language, Social Studies, and Music and Art." (A Doctor's dissertation now in progress at the University of Washington, Seattle, Washington).

**ATTITUDES OF EDUCATORS AND STUDENTS IN UTAH TOWARD MANUAL LABOR AND MANUAL WORKERS**

(Publication No. 18,586)

William Earl Mortimer, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. H. H. London

**PURPOSE OF STUDY:** The purpose of the study was to ascertain the attitudes which educators and students in Utah hold toward manual labor and manual workers, to find out if there were significant differences in attitude among the various groups, and to see if any relationship existed between the general level of intelligence of the students and their attitudes toward manual labor and manual workers.

**METHOD OF RESEARCH:** Data were obtained from an attitude scale prepared for the purpose and incorporated into an information form which was administered to randomly selected educators and students in Utah, from high school and vocational school records, and from literature in the field.

**SUMMARY:** Four types of students were used, namely industrial arts, trade and industrial, vocational agriculture, and regular students. There were counterparts for these groups among teachers. In addition to teacher groups, superintendents, principals, and counselors were added to make up the total group of educators.

Mean scores on the attitude scale indicated that all groups had attitudes toward manual labor and manual workers which were more favorable than they were unfavorable.

Among teacher groups, trade and industrial teachers had the most favorable attitude, with industrial arts, vocational agriculture, and regular teachers following in that order.

Superintendents, principals, and counselors had similar attitudes, however, the mean scores showed superintendents to have the most favorable attitude with principals and counselors following in that order. Industrial education teachers, as a single group, had a more favorable attitude than administrators and counselors, as a single group. Administrators and counselors had a more favorable attitude than regular teachers.

Among student groups, trade and industrial students had the most favorable attitude. Vocational agriculture students were next, then industrial arts students, and finally regular students.

Vocational agriculture teachers and students had similar attitudes, but between all other teacher groups and their counterpart in student groups, there were significant differences. Regular students had a more favorable attitude than regular teachers; in all other cases, teachers had the more favorable attitude.

Comparisons made by sex showed male educators to have a more favorable attitude than male students. Between all male students and all female students, the female students had the more favorable attitude.

Participants were classified into union and non-union groups according to membership in labor unions or association with labor union members in the family. In general, the union groups had more favorable attitudes.

Three specific items from the attitude scale were selected for examination. The first was the statement, "Only those of less than average intelligence should receive training as manual workers". In general, all groups showed disagreement with the statement.

The second statement was, "Public money spent for training manual workers could have been used more wisely for other purposes". In general, all groups showed disagreement with this statement.

The third statement was, "Manual workers have become so strongly organized into labor unions that they are becoming a threat to the economy of the nation". With all groups there was a greater spread of responses than with the other two statements. In general there was disagreement with it but not as strongly as on the other two statements.

Comparisons made of the intelligence of the various groups showed industrial education students to be only slightly lower than regular students.

Calculations made to ascertain the relationship between intelligence quotients and attitudes towards manual labor and manual workers showed that no real relationship existed.

239 pages. \$3.10. Mic 56-3282

## A STUDY OF TERMINAL EDUCATION IN THE JUNIOR COLLEGES OF CONNECTICUT

(Publication No. 17,665)

Charles Frederick Petitjean, Ed.D.  
New York University, 1956

Chairman: Professor Paul S. Lomax

### The problem and its importance

The purpose of this research investigation was to determine how adequately the terminal curricula in the nine Connecticut Junior Colleges, and the four Teachers Colleges, were meeting the needs of the students and the communities which they served. During the past two decades, these colleges have made little adjustment to changing needs. In the next decade, as higher education enrollment grows, their terminal curricula must be prepared to meet the challenge.

### The historical and theoretical background of the problem

Few studies have been made in the East relating to junior college terminal curricula, and none in Connecticut. While the majority of these colleges are still private institutions, the development of two-year programs in the Teachers Colleges has provided public junior colleges. In addition, there have developed four-year colleges, with the junior college as a two-year base.

### The procedure

A study was made of the terminal curricula, through catalogs and personal visitation, of the Connecticut institutions which fell within the scope of this project. Data were obtained as to present student enrollment in terminal curricula, high school background of students, and names of terminal graduates.

To faculty teaching in terminal curricula, a questionnaire was distributed, seeking information related to degrees, major fields, present teaching, and past experience, both in teaching and in other occupations. The terminal graduates were mailed questionnaires requesting data on present occupation, educational background, junior college experiences as related to occupational needs, and improvement of the junior college.

Finally, occupational data were sought, by mail and personal visitation, from the state labor department, state employment agencies, and college placement officers to indicate the need for terminal graduates.

### The results

The Connecticut Junior Colleges had twenty-four different curricula containing 163 different courses. Fifteen of these curricula occurred only once. Eighty per cent of the students in these curricula came from secondary schools within the state. A college preparatory curriculum was the background for approximately half of the graduates, the rest having had the commercial or general curriculum. Approximately one-third came from the lower half of their graduating class.

Faculty members were well-prepared in education and experience. They represented a wide diversity of educational institutions, and ninety-four per cent of them had master's degrees or higher. There was a weakness evident in professional education preparation, particularly as related to teaching in junior colleges.

Nearness to home, and availability of desired curriculum, were major reasons why graduates had chosen the junior college. There were few complaints from the graduates, and essentially there appeared to be satisfaction with training received. Graduates listed technical subjects as most valuable, but indicated the desirability of cultural subjects.

Finally, there were no occupational data within the state which could adequately determine the need for present, or future, two-year terminal graduates.

#### Conclusions and recommendations

It was concluded that the Connecticut Junior Colleges offered a well-diversified selection of terminal curricula, but attracted students from a limited distance. There was little evidence of curricula planned to meet state or community occupational needs. Insufficient cultural offerings were indicated. The faculty members were well-qualified in terms of experience and education. Adequate vocational advice was not provided for graduates.

It was recommended that the Connecticut Junior College Conference conduct research as to future additions or deletions of curricula among its members. There should be encouragement for considerable study of the occupational needs within the state. Finally, each college should evaluate its present practices in relation to the general findings of this study, in an effort to improve the entire junior college program in the state.

167 pages. \$2.20. Mic 56-3283

#### **STATE INSURANCE OF PUBLIC SCHOOL PROPERTY IN MICHIGAN**

(Publication No. 17,164)

George R. Robinson, Ed.D.  
Wayne University, 1956

Adviser: Dr. W. Ray Smittle

School districts in the State of Michigan have a tremendous investment in buildings and contents which must have maximum protection from loss by fire. The insuring of school district property entails the annual expenditure of a large sum of money. The study of the experience of self-insurance programs in states and cities, combined with a Michigan survey, was made in order to determine the advisability of a similar plan for Michigan.

The laws of the states having self-insurance, Alabama, North Carolina, North Dakota, South Carolina and Wisconsin, were analyzed and compared on the basis of twenty-eight criteria. The experience of cities having self-insurance programs was explored.

Michigan adopted a state insurance law in 1913 which insured only state-owned property. This statute was examined to determine whether or not public school property could be included if desirable.

A survey of the school districts in Michigan was conducted by means of a questionnaire sent to all superintendents who employed ten or more teachers. A total of 510 questionnaires were sent, of which 392, or 76.9 per cent, were completed and returned.

Two school districts are self-insured for fire losses,

Detroit and Grand Rapids. The Detroit program maintains a reserve fund which is very small in relation to insurable values. The purpose of the reserve fund is to cover minor fire losses. In the event of a major loss it would be necessary to vote a tax for the purpose of replacement. Grand Rapids maintains a partial self-insurance program. Insurance of modern fire-resistive buildings is assumed by the district, and older structures are covered through re-insurance. The remaining 390 school districts that answered the questionnaire utilized commercial insurance. Approximately 58 per cent of the school districts availed themselves of the services of stock companies. Twenty-five per cent insured with mutual companies, and approximately 17 per cent carried insurance in both stock and mutual companies.

Slightly more than 90 per cent of the school districts of the state of Michigan use coinsurance. Fifty-five per cent of the districts use the 80 per cent coinsurance clause, 38 per cent use the 90 per cent clause, and approximately 3 per cent are covered by a combination of 80 per cent and 90 per cent coinsurance. An analysis of the data indicates that school districts are not properly applying the coinsurance clause. Only fifty-five districts, or less than 30 per cent of the districts carrying 80 per cent coinsurance, actually are within a range of 75-85 per cent of the estimated replacement cost. Fifty-nine districts, or 38 per cent of the same group reporting are underinsured. Statistics for the group of districts carrying 90 per cent coinsurance reveals that 52 per cent of the group reporting replacement costs are underinsured from 10-70 per cent. The tendency to overinsure is somewhat reduced when the 90 per cent coinsurance clause is used.

Of the districts reporting the number of years on which insurance is written, nearly 72 per cent are using the five-year term, and 25 per cent are insured under three-year policies.

Of the 391 reporting districts, 81.6 per cent suffered no fire loss in the last ten years. Of the sixty-nine districts that reported fire losses, 50 per cent of them sustained damage amounting to less than one year's annual premium, and 44.9 per cent suffered damage amounting to more than one year's premium. There were thirty-one districts in this group that sustained damage amounting to more than one year's premium, of which ten had losses of less than two years' premium. It is seen that 364, or 93.1 per cent, of all districts reporting sustained either no loss, or fire damage amounting to less than two years' annual premium over a ten year period.

There appears to be sufficient evidence supporting the establishment of a self-insurance program for the public schools in Michigan. The assumptions of prerequisites for self-insurance are fulfilled in that the risks are spread on a geographic basis, coverage is wide-spread and fairly uniform.

Two proposed plans of self-insurance for the State of Michigan are submitted in this study. The proposed plans are in no way to be considered as complete solutions to the problem of self-insurance, but rather as frameworks upon which qualified and professional authorities might mold a self-insurance program. It is recommended that further study be made in an effort to amend the present statutes or to introduce a new plan of state self-insurance. It is further recommended that school boards, school administrators, and educators throughout the state encourage the adoption of a self-insurance plan to include public school district property.

155 pages. \$2.05. Mic 56-3284

**A CLASSIFICATION AND ANALYSIS OF INCIDENTS  
OF GOOD AND OF POOR SCHOOL CITIZENSHIP,  
TOGETHER WITH THE REASONS THEREFOR,  
AS REPORTED BY SECONDARY SCHOOL PUPILS  
AND BY INSTRUCTIONAL PERSONNEL IN TWELVE  
SCHOOLS OF FLORIDA AND SOUTH GEORGIA**

(Publication No. 18,674)

Morris George Sica, Ed.D.  
The Florida State University, 1956

This is an exploratory study of school citizenship based upon incidents of good and of poor citizenship behavior in school, together with the reasons therefor, as reported by a sampling of pupils in grades seven through twelve, inclusive, in selected schools of Florida and South Georgia and as reported by a sampling of instructional personnel in the same schools.

A group interview procedure was utilized in gathering data from 1,014 pupils in thirty-six classrooms. The pupils reported 4,126 incidents and 4,119 reasons. Forty-eight instructional personnel reported 259 incidents and 259 reasons.

In the prosecution of this study the investigator, starting with the responses of pupils and of instructional personnel, sought inductively to classify the several reported incidents and reasons therefor into meaningful categories that would be both comprehensive and, in so far as possible, discrete.

The incidents of good and of poor behavior are classified within twelve categories and ninety-four sub-categories. The reasons presented for judging citizenship behavior to be good or poor are classified within eight categories. Each category and sub-category is accompanied by a description of the types of responses included therein.

On the basis of the categories so established, the investigator examined the responses obtained for the purpose of evolving meaningful and tenable hypotheses concerning the development of concepts of school citizenship by pupils and concerning concepts of school citizenship held by instructional personnel.

A comparison was made of the principal sub-categories of citizenship behavior based upon the sensitivity of students with the citizenship behaviors identified by the Educational Policies Commission and a citizenship committee of the National Council for the social studies as being essential to democratic citizenship.

Examinations of the categories of incidents were made to discern areas of relationship:

1. The relationship between the time interval and the relative frequency of incidents as reported within the several categories.

2. The relative sensitivity of the population of pupils included in this study, of intact school groups, and of pupils at the several grade levels to incidents of good and of poor behavior.

3. The principal categories of good and of poor citizenship behavior to which pupils indicate their greater sensitivity.

4. Comparison of the principal categories of citizenship behavior based upon the sensitivity of instructional personnel with the principal categories of citizenship behavior based upon the sensitivity of pupils.

5. Identification of the principal categories of citizenship behavior to which pupils at the several grade levels

indicate their greater sensitivity, together with a comparison by grades of the sensitivity of pupils to each of the previously designated principal categories.

6. Identification of the principal categories of citizenship behavior based upon the sensitivity of pupils by schools, accompanied by a comparison by schools of the sensitivity of pupils to each of the previously designated principal categories.

7. Identification of the principal categories of citizenship behavior based upon the sensitivity of pupils in rural and in urban communities, accompanied by a comparison of the sensitivity of pupils of rural and or urban communities to each of the previously designated principal categories.

The examinations of the categories of reasons closely paralleled the investigation of the categories of incidents.

The generalizations suggested by evidence provided through the previously described examinations are stated as hypotheses in need of further verification by studies bearing directly upon them.

272 pages. \$3.50. Mic 56-3285

**THE EDUCATIONAL THEORIES OF  
GEORGE BERNARD SHAW**

(Publication No. 17,673)

Louis Simon, Ph.D.  
New York University, 1956

The purpose of this study was to formulate the educational theories of Shaw as presented in his dramatic and non-dramatic work, to determine whether these theories constitute a philosophy of education, and to evaluate these theories in the light of certain criteria for a democratic philosophy of education. Other problems involved the social, economic, philosophic, scientific, religious, and literary background against which Shaw wrote, with emphasis on the past and contemporary state of English education; Shaw's criticism of his own early education; an analysis of Shaw's method of reasoning as an artist-philosopher, and of his polemical methods.

**Method:**

A. Since there was adequate evidence that Shaw had formulated, in the broad sense, a philosophy of education, his theories about education were classified under the following categories, which were justified as criteria determinant of a philosophy of education: the nature of the individual; the society in which he lives (or ought to live); the growth of personality; the educative process; the functions of the schools; the meaning of life. Six chapters, titled accordingly, constitute the bulk of the thesis.

B. Ideas about education in the non-dramatic work were compared and contrasted with those embodied in the plays. Any differences or extensions of thought in the plays -- particularly between preface and play -- were noted.

C. Shaw's theories were evaluated by comparing and contrasting two sets of criteria: one deriving from the formulated theories of Shaw, and the other the researcher's own determinant of a democratic philosophy of education.

**Conclusions:**

A. Non-democratic ideas in Shaw's educational philosophy  
 1. Shaw supports the concept of an all-powerful state as the dominant factor in the control of education. This could easily lead, even assuming benevolence, to totalitarian disciplines in the schools. Education could become the handmaiden of an official ideology (socialism and creative evolution in Shaw's case) and fail to influence the reformation of social policy or the redirection of social change, precisely what Shaw attacked in capitalist democracies. While Shaw advocates educating the young to want liberty, he also insists that unless they fit themselves to live in a civilized society they cannot be allowed to live at all. Shaw neither clarifies the end-means complex nor succeeds in reconciling individual liberty in the schools with his principle of collective discipline.

**B. Democratic ideas**

1. Shaw upholds the worth, dignity, and unlimited potential of each individual, the vital experiment of the Life Force. A well-integrated society which creates a richer social and cultural environment will breed richer individuals, freed of economic encumbrances. Learning and growth can be realized through profound experiences in art (particularly music and drama) and in intellectual controversy. The educative process, democratized in an atmosphere of emotional and intellectual liberty, predicates the creation of "passion beings" dedicated to their own betterment and to that of civilization, present and future.

2. To enable the schools to prepare individuals for the living experiences of life, Shaw urges: active, experiential, creative aspects of learning; curricula patterned to life's needs; better teacher training; objective study of all prevailing religious creeds; early instruction in sex and marriage; adequate vocational guidance; elaborate programs of adult education; state-supported community colleges accessible to anyone; critical evaluation of mass media of communication; selection and training of society's leaders; creation of mature individuals capable of understanding that intellect is a passion and capable of willing growth.

3. If man has increasing power to influence his own future evolution, responsibility for defining and for realizing the ends sought rests with a state and its educational institutions. Interpreted in terms of the democratic ideal, Shaw's doctrine of Creative Evolution presents a profound challenge to the democratic philosophy of education.

405 pages. \$5.20. Mic 56-3286

**EDUCATION, ADMINISTRATION****A STUDY OF THE ORGANIZATION AND CONTROL  
OF STATE SUPPORTED HIGHER EDUCATION  
AS REPORTED IN SELECTED SURVEYS**

(Publication No. 18,571)

Marshall Arnold, Ed.D.  
University of Missouri, 1956

Supervisor: W. W. Carpenter

**PURPOSE:** The major purpose of this study was to study some of the factors related to the organization and con-

trol of state supported higher education in the United States between 1933 and 1955-56 as reported in selected surveys. It was also concerned with showing some of the changes that had taken place between those two dates and to point up the interest shown in the problems of organization and control as indicated by the recommendations advanced by selected state surveys.

**METHOD OF RESEARCH:** This study was a descriptive survey. The primary data were obtained from nationwide surveys by The Carnegie Foundation for the Advancement of Teaching in 1933 and the U.S. Office of Education in 1954, from the returns of an Information Blank sent to the chief state school officer in each state, and from the reports of selected state surveys between 1933 and 1955-56. The status of selected factors pertaining to the organization and control of state supported higher education were reported for 1933 and for 1955-56 and the changes that had taken place were noted. The recommendations of state surveys were reported as they were concerned with the organization and control of state supported higher education.

**SUMMARY:**

- (1) The increase of 30 state supported institutions of higher education was accomplished with an increase of only two governing boards.
- (2) Although there was a great diversity of titles used for governing boards in both 1933 and 1955-56, the titles Board of Trustees, Board of Regents, and State Board of Education or similar titles, accounted for over 80 per cent of the titles used in both years.
- (3) There was a wide range in the size of governing boards in 1933 and 1955-56, although in both years over 80 per cent had from 5 to 13 members.
- (4) In 1933 there were more governing boards of seven members while in 1955-56 there were more nine member governing boards.
- (5) In both 1933 and 1955-56, over 57 per cent of the members of governing boards were selected by appointment by the governor, increasing in frequency in 1955-56.
- (6) There were fewer ex officio members on governing boards of state supported higher education in 1955-56 than reported in 1933.
- (7) The governor was an ex officio member of fewer governing boards in 1955-56 than in 1933.
- (8) There were more 6 year terms for governing board members in both 1933 and 1955-56 and over 66 per cent served terms of 4 to 7 years.
- (9) There was an increase in the use of coordinating boards between 1933 and 1955-56 and in the degree of authority they exercised over state institutions of higher education.
- (10) There were fewer governing boards with authority over a single institution in 1955-56 than in 1933.
- (11) The recommendations of 53 state surveys consistently called for some plan designed to achieve a higher degree of coordination in the state system of higher education.

**CONCLUSIONS:**

- (1) The growth of state controlled institutions of higher

education has been primarily the result of expanding and consolidating the institutions already existing rather than by creating new institutions.

- (2) There was a slow but continuous trend toward a greater degree of coordination in the control of state supported higher education between 1933 and 1955-56.
- (3) Of the three general plans recommended by state surveys to achieve greater coordination in the control of state supported higher education, namely by voluntary cooperation, by creating a coordinating board, or by creating a single state board of higher education, there was no conclusive evidence that any one of these plans was more highly favored by the various state survey groups.

392 pages. \$5.00. Mic 56-3287

**THE EXTENT OF CERTAIN SUPERVISORY FUNCTIONS PERFORMED BY SUPERVISING PRINCIPALS IN SELECTED PUBLIC WHITE SCHOOLS OF ALABAMA**

(Publication No. 18,696)

Paul Garber Blacketor, Ed.D.  
Alabama Polytechnic Institute, 1956

Supervisor: W. Theo Dalton

**THE PROBLEM**

Supervision is an area of the school program which demands much attention of the principal. This study attempted to determine the extent of those practices which supervising principals in Alabama perform with respect to the various supervisory functions. More specifically, this study was:

1. To discover the extent of the relationship of the principal to the development of curriculum in the local school.
2. To point out the degree to which instructional improvements are being cooperatively conducted by the principal and faculty.
3. To indicate the amount of principal's activity in the testing program conducted in the local school.
4. To designate the extent of activity on the part of the principal to produce professional growth within the faculty.
5. To measure the efforts of the principal in developing good rapport among the faculty.
6. To relate existing supervisory practices among principals to types of school organization.

**PROCEDURE**

This study was conducted by a checklist which was first submitted to a panel of authorities in supervision. The revised checklist was then sent to certain non-teaching principals in Alabama, and to selected teachers from the same

schools. There were 118 principals and 298 teachers who reacted to the checklist.

The schools for this study were selected from the nine counties of the 1945 American Council on Education study, Public Education in Alabama, and eight counties selected according to distribution of population and location throughout the state. Only those schools having twelve or more teachers were included.

**FINDINGS AND CONCLUSIONS**

The findings of this study appear to justify the conclusion that the supervising principals of Alabama are generally conservative and traditional in their supervisory practices.

In the area of curriculum improvement, the principals have need for involving the teachers and pupils more in the planning of instruction.

The principals do much more to aid the teachers in a general way with instruction than in any specific area.

The principals do not always aid the teachers in the supervision and administration of the testing program in the local school.

Generally, the teachers are not as optimistic about the amount of help given in the area of professional growth as are the principals.

The principals are most helpful in the area of professional relationships. They rate themselves high in this section and the teachers tend to be in general agreement. However, this study revealed that there is a tendency toward an authoritarian attitude on the part of some principals who are reluctant to accept the conclusions of the group.

The principals of elementary schools give more supervisory help than do other types of principals.

The following basic recommendations are made:

1. The pre-service preparation of the principal should include a thorough knowledge of supervisory principles and functions. A period of internship would contribute to this kind of understanding.

2. The principal should gain insight into the need for including teachers, pupils, and lay public in the development of the curriculum.

3. The principal should see his role in educational leadership as quite different from that of a school clerk. Proper delegation of clerical duties will provide time for more adequate supervision.

186 pages. \$2.45. Mic 56-3288

**A COMPARISON OF ATTITUDE DIFFERENCES AND CHANGES OF COLLEGE FRESHMAN MEN LIVING IN VARIOUS TYPES OF HOUSING**

(Publication No. 17,312)

Roger Jay Fritz, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor A. H. Edgerton

This study was undertaken to investigate and identify the differences and changes in attitude toward various aspects of the academic and social life of freshman groups

of men students at Purdue University. Because of the fact that such a study might provide needed information and greater insight into the problems involved in housing men during the forthcoming years of predicted high enrollments, those studied lived in all of the different types of residence accommodations available to undergraduate men at Purdue University. In addition to the three types of housing which accommodate most men students at Purdue, namely, university operated residence halls, fraternity houses, and off-campus rooming houses, groups were also studied who lived in the following types of housing: apartments, homes of parents or relatives, cooperative houses, federal housing projects for married veterans, trailers, and homes owned by the student.

An eight-part attitude scale was administered to 486 randomly selected freshman men in October, 1954, and to 390 of these individuals in April, 1955. The 150 items on the scale were classified in the following areas: Money and Finance, Social Relationships and Activities, Personal and Interpersonal Relationships, Relationships with the Opposite Sex, Home and Family, Study Problems and General College Life, Vocations and the Future, and Religion and Philosophy.

The objective of this study was basically exploratory and the following hypotheses were tested in conducting the investigation:

1. Significant group differences exist between the expressed attitudes of randomly selected men who live in different types of housing accommodations at both the beginning and the end of their freshman year at Purdue University.
2. Significant differences in attitude change exist between groups of randomly selected men who have lived in different types of housing accommodations during their freshman year.
3. Significant group differences exist between the expressed attitudes of randomly selected men who pledge social fraternities during their freshman year and those who do not.

Several other variables were also studied because of the need to account for some of the factors which could influence attitudes before the study was made and during the interval between testings.

Significant differences in attitude were found as follows: Social Relationships and Activities. Men who lived at home with their parents scored significantly lower than those who lived in university residence halls and fraternity houses at both the beginning and the end of their freshman year.

Relationships with the Opposite Sex. Men living in fraternity houses scored significantly higher than those who lived in off-campus rooms at both the beginning and the end of the year. In addition, fraternity pledges scored significantly higher than non-pledges in this area.

Home and Family. Those who lived at home with their parents scored significantly lower than those who lived in residence halls, fraternity houses and off-campus rooms at the beginning of the year.

Total Scores. Those men living at home with their parents had significantly lower total scores on the entire scale than those who lived in residence halls, fraternity houses, and off-campus rooms at the beginning of the year, thus indicating less favorable attitudes.

Attitude changes were predominantly negative, that is, in the direction of being less favorable at the end of the freshman year than at the beginning.

125 pages. \$1.70. Mic 56-3289

#### PROFESSIONAL AND LAY PARTICIPATION IN THE CENTRAL ADMINISTRATION OF OHIO'S CITY AND EXEMPTED VILLAGE SCHOOL SYSTEMS

(Publication No. 18,798)

Paul Kenneth Howells, Ph.D.  
The Ohio State University, 1956

#### Orientation to the Study

The purposes of the study were (1) to describe the status of central-staff services and of district-wide groups in Ohio city and exempted village school districts and (2) to describe and analyze the opinions held by three classes of persons (superintendents, other professional personnel, and laymen) concerning the values achieved by district-wide groups in those districts.

The data were gathered through (1) study of certain mandatory reports of 214 school superintendents to the State of Ohio Department of Education and (2) study of special inquiries responded to by 147 of these superintendents, 51 central-staff members, 101 school principals, 62 classroom teachers, and 36 laymen. Seventy-two per cent of all recipients of special inquiries returned usable responses.

Status data related both to central services and to district-wide groups were analyzed in terms of five enrollment ranges: 497 - 1,250; 1,251 - 2,500; 2,501 - 5,000; 5,001 - 10,000; and 10,000 and above. Evaluative judgments concerning district-wide groups were analyzed in terms of four group-utilization patterns ranging from no group utilization to extensive utilization of groups involving classroom teachers and laymen as well as administrative personnel.

#### Conclusions concerning Central Services

1. Enrollment is a better basis for comparison of the extent and kind of central services in Ohio schools than is municipal population, financial support, or the city - exempted village dichotomy peculiar to Ohio.
2. Provision for central-staff instructional supervision first becomes general in the 2,500 - 5,000 enrollment range.
3. Provision for central-staff services supplementary to, but not supervisory of, instruction first becomes general in the 5,000 - 10,000 enrollment range.
4. Provision for the services of central-staff members whose average salaries are higher than those of school principals first becomes general in the 5,000 - 10,000 enrollment range.
5. Provision for the services of central-staff members whose average salaries are between those of classroom teachers and school principals first becomes general in the 2,500 - 5,000 enrollment range.

6. Central-staff members whose services emphasize the managerial function, and who receive average salaries higher than those of classroom teachers, are more commonly provided, regardless of the enrollment range, than central-staff members whose services emphasize the supervision of instruction.

Conclusions concerning District-wide Groups

1. In respect to purpose and continuity, the most commonly found district-wide groups in Ohio are those with continuing, broad purposes.
2. In general, respondents consider the four types of groups defined in the inquiry — superintendents' cabinets, superintendents' advisory councils, district-wide committees, and citizens' committees — useful in the central administration of school districts.
3. Of the above types of groups, superintendents' cabinets are the most widely used, superintendents' councils the least.
4. In general, members of superintendents' councils and of citizens' committees are selected by their peers, whereas members of district-wide committees are appointed by status leaders almost as often as they are selected by their peers.
5. The majority of chairmen of district-wide committees hold their positions through appointment by status leaders, whereas the majority of chairmen of citizens' committees hold their positions through selection by their peers.
6. Four positive influences often claimed for democratic participation are achieved by district-wide groups in the following order: (1) improvement of public relations, (2) achievement of educational objectives, (3) improvement of professional employees' morale, and (4) effect on district-wide policies.
7. In general, the four influences listed increase as the pattern of group utilization grows more extensive and involves a greater variety of participants.
8. Of the four influences, positive effect on policies is increased the most by extensive and democratic involvement of group participants.

222 pages. \$2.90. Mic 56-3290

**CURRICULUM DEVELOPMENT IN VOCATIONAL-TECHNICAL EDUCATION: WITH SPECIAL REFERENCE TO THE NORFOLK DIVISION OF VIRGINIA STATE COLLEGE**

(Publication No. 17,157)

Harry Leroy Johnson, Ed.D.  
Wayne University, 1956

Adviser: Dr. Charles L. Boye

The purpose of this study was to determine the need for establishing a program of vocational-technical education at the Norfolk Division of Virginia State College. The

institution is a publicly-supported community junior college located in Norfolk, Virginia, the largest metropolitan area in the state.

The activities of the technician serve best in identifying his position relative to other occupational groups. He sometimes acts in a supporting role to professional workers; frequently he employs the skills of the craftsman; his responsibilities may be chiefly supervisory; or a combination of sales techniques and a comprehensive understanding of product utilization may be required of him.

The technical education program has been defined as a phase of vocational-education designed to prepare individuals for entry into or upgrading in technical occupations. It has come to occupy, in general, a post high school position in the educational ladder and usually approximately two years of full time training or the equivalent in part time training is required.

A careful study of the literature reveals several significant trends in regard to vocational technical training programs:

1. There is a felt need for strong vocational technical progress throughout the country as a result of marked technological advancement in industry and business in recent years.
2. Programs have been set up in various types of institutions in an effort to meet the need for technically trained workers.
3. The technical institute type program probably represents the most direct approach to effective vocational-technical training.
4. The junior or community college is accepting an increasing responsibility for training technical workers in a variety of fields and in many parts of the country.

Scientific inventions and technological developments have contributed to major changes in the structure of the labor force of the nation in the past fifty years and have played an important role in determining trends in our present economy. Increased capital investment in equipment and machines, the general rise and skills and understandings required in many occupational activities, and the increasing complexity of our economic structure, all indicate a need for more highly educated and trained personnel.

The South Atlantic States Region, including Virginia, reflects the trends of the nation and because of the rapid industrialization of the South, shows a more remarkable growth in technical personnel than does the nation as a whole. A local survey conducted by the author in the Norfolk-Portsmouth Community revealed an estimated total of 7,268 technical workers in the area. Based on these findings, a total of 289 annual replacements in technical occupations was determined. The following table indicates more detailed findings of this survey.

Perhaps the two most significant implications drawn from this study are:

1. The Norfolk Division of Virginia State College is a logical center for a program of vocational-technical education in terms of the objectives and purposes of the institution, present and proposed facilities, and probable utilization of the program.
2. Need in the local community for facilities to train technical personnel is adequate to warrant proposing

programs in several occupational fields as demonstrated by the local survey. Additional areas of training would be added as the need develops and facilities are made available.

TABLE I

**ESTIMATED TOTAL TECHNICIANS EMPLOYED  
IN THE NORFOLK-PORTSMOUTH COMMUNITY  
AND ESTIMATED ANNUAL REPLACEMENTS,  
BY CURRICULUM**

Curriculum	Total Technicians	Estimated Annual Replacements
Air Conditioning and Refrigeration		
Technology	128	5
Automotive Technology	853	34
Building Construction		
Technology	901	36
Drafting Technology	435	17
Electrical and Electronics		
Technology	1726	67
General Business		
Technology	821	33
General Supervision		
Technology	753	30
Industrial Chemistry		
Technology	304	12
Instrument Repair		
Technology	347	13
Laundry and Dry Cleaning		
Technology	198	8
Mechanical		
Technology	387	15
Other	415	17
<b>Total</b>	<b>7268</b>	<b>287</b>

196 pages. \$2.45. Mic 56-3291

**AN INVESTIGATION OF EMPLOYMENT TECHNIQUES  
WITH SPECIAL REFERENCE TO THE SELECTION OF  
COLLEGE GRADUATES BY BUSINESS AND INDUSTRY**

(Publication No. 18,719)

Kermit Kent Johnson, Ph.D.  
Bradley University, 1956

This investigation was an effort to study the characteristics and traits which the industrial and business firms interviewing students on the university campus desire to find in the college graduate job applicant. The primary problems of this investigation were: (1) a study of what appear to be emergent factors in personnel selection interviewing as conducted by 219 business and industrial firms at Bradley University, and (2) the presentation of a discussion of the rating of traits used in the initial employ-

ment interview by the company interviewer with special reference to the employability of college graduates in business and industry.

To facilitate such an investigation, a research instrument was designed and used consisting of two parts. The first part consisted of a twelve-item opinionnaire which was mailed to the executive personnel officers of the 341 industrial and business firms that had been in direct contact with the university Placement Office during the past 4 years (1952 to 1956). Of these firms, 219 participated in the study. The second part of the research instrument was designed in two sections (1) to obtain ratings of the interviewee by the company interviewer, and (2) to obtain ratings by the job applicant on the company interviewer. 8 traits appeared in common on both sections of this part of the research instrument. A subsection on the second part contained a self-appraisal portion that was filled out by the applicant projecting how he felt the interviewer rated him with respect to suitability for employment. From the company interviewers, 1168 ratings were received and these were compared with the reciprocal ratings of the job applicants. 114 companies took part in this portion of the study, which covered one complete placement year. Responses were received from all parts of the United States, and in about equal quantity from small and large industrial firms.

Three methods of treating data were used: (1) statistical tabulation of a company representative's ratings to see how many agreed with those ratings of the interviewee, (2) statistical computation of the correlation of both the interviewer's ratings and the applicant's ratings, which resulted in a mean coefficient of correlation of .14 and a mean probable error of .35, and (3) an item analysis comparison of mutual interviewee-interviewer ratings for the extreme ratings, that is, "excellent" prospects, "not suitable" prospects, and "doubtful" prospects. The latter method proved more valid than the previous two.

It was apparent from this study that most companies have a personnel department and the majority of these administer their own personnel selection tests. These tests tended to measure intelligence, personality, and interest. The interview was found to play an important part in personnel selection, as about one-half of the companies preferred two or more interviews. Two-thirds of the companies placed a great emphasis on grades received in college, three-fourths of the companies prefer persons who have had part-time work experiences, and two-thirds prefer persons who have one-half of their college educational background in the liberal arts area. Much stress lately has been placed on the use of oral English; the results of this study fail to show this concern on the part of companies seeking college graduates.

Likeable and co-operative, appearance and poise, enthusiasm and vitality, alertness, and tact and verbal fluency seemed to be the chief characteristics that the company looks for in the applicant. There seems to be no relationship between the interviewer's rating of individuals on the separate traits and his overall evaluation of the applicant as a suitable employee. It would appear that a single overall rating of suitability is as valuable in selection technique as the more detailed trait evaluation. Interviewees were found to evaluate themselves rather accurately with respect to suitability, with a slight tendency to underestimate themselves. No agreement seems evident between interviewer-interviewee ratings, interviewee-interviewer

ratings, or the interviewer's ratings and the interviewee's self-ratings. It seems the individual personality, prejudices, and idiosyncrasies of the interviewer and the interviewee's ability to adjust to these may be one of the chief determinants of suitability for employment.

83 pages. \$1.50. Mic 56-3292

**AN ANALYSIS OF PUBLIC OPINION IN  
A SCHOOL DISTRICT WITH RESPECT TO  
SELECTED ASPECTS OF PUBLIC EDUCATION**

(Publication No. 16,958)

Guy D. Jones, Ed.D.  
University of Arkansas, 1956

Major Professor: Roy B. Allen

**I. THE PROBLEM**

In conducting public secondary education, school authorities are faced with many problems, among which are the following: (1) keeping school programs up-to-date and in harmony with recognized social needs; (2) acquiring continuous and adequate financial and moral support of improved public education.

In order to accomplish these purposes, harmony of understanding between school and public is essential. Requisite to this harmony is school appreciation of the opinions and attitudes of the people with respect to: secondary objectives accepted by educational authority; educational needs of high school pupils; the educational program of the local high school; and the quality of that program. Of similar importance to school authorities are public attitudes concerning the general needs of local education, and the influences affecting public opinion.

**II. SOURCES AND TREATMENT OF DATA**

In conducting the present survey, the writer catalogued the adult population of the Gentry, Arkansas, School District and selected a representative sample.

Individuals selected were interviewed by use of scheduled questions; definite opinions, uncertainty, and lack of knowledge were recorded. Status of respondents as to selected groupings was also recorded.

These data were tabulated to show percentages of the different responses by individuals, both as members of groups and of the sample.

This tabular record was then analyzed rationally and statistically and meanings interpreted.

**III. FINDINGS**

As appropriate areas of high school instruction and representing instruction urgently needed, the three R's were placed in first rank. Remaining areas ranked as follows: speech, health education, citizenship, ethics, home economics, industrial arts, physical recreations for all, agriculture, business education, social living, mathematics, the sciences, social graces, music, girls' occupations, literature, art, and foreign languages.

Agriculture, home economics, and business education programs were familiar to the public, and were viewed

with approval. Citizens believed improvement necessary in other areas. Approximately one-fourth of respondents had no information about the local program.

Opinion ranked general needs as follows: higher salaries for teachers, youth center with dancing, and elimination of corporal punishment. The public favored immediate action, and signified willingness to pay higher taxes for these purposes.

School information was communicated largely from friends and the local newspaper; such information was considered reliable, other information unreliable. Respondents would not act on information from any single source, but would consult the school, friends, and pupils for needed school information. Influence by organizations or persons of prestige was denied.

**IV. CONCLUSIONS**

(1) The people of Gentry District base their judgments in school matters on a utilitarian philosophy.

(2) Opinion in the Gentry District ranks area objectives for appropriateness for secondary education: fundamental, developmental, occupational, college preparatory, and aesthetic.

(3) Local opinion ranks urgent educational needs of youth as follows: proficiencies of everyday living, rounded development, and economic preparation.

(4) People of Gentry District appreciate only those portions of the local program which contact the community.

(5) Lack of public information as to school matters indicates lack of communication between school and community.

(6) Attitudes of the people of this district toward school improvement show desire for improved education and willingness to pay for it.

(7) The information and influence pattern seems to indicate lack of harmonious understanding between school and public.

**V. RECOMMENDATIONS**

(1) A study of methods of instruction in this district is recommended.

(2) A program of public familiarization with school matters is proposed.

(3) A program of local school improvement along opinion-indicated lines is indicated.

(4) Duplicate studies in other school districts of the state are suggested.

217 pages. \$2.85. Mic 56-3293

**AN ANALYSIS OF THE FUNCTIONS OF  
THE DISTRICT SUPERINTENDENT OF  
SCHOOLS IN PENNSYLVANIA**

(Publication No. 17,241)

Raymond Heisey Koch, Ph.D.  
University of Pennsylvania, 1956

Supervisor: Dr. William E. Arnold

**PURPOSE:**

This study is concerned with the discovery of the problems facing the district superintendent of schools in

Pennsylvania as a basis for determining the nature of his official duties. It is also concerned with determining whether superintendents with different degrees and types of experience working in different types of districts are faced with the same or different kinds of problems.

#### PROCEDURE:

While current literature was canvassed for the purpose of determining some of the problems and duties which authorities in the field have enumerated, the main procedure used to obtain the data for this study was study conferences of superintendents, principals or teachers, school board members, and citizens not officially connected with the schools.

A Study Guide serving the following three main purposes was prepared for use by the study conferences: a. as a guide to program participants in their study of superintendents' problems and the conditions around the superintendents as they faced these problems; b. as a convenient place for recording the opinions of the study participants; and c. as a source of data for the study. The data were reported in the Study Guide by recorders who were instructed in the use of the Study Guide.

#### CONCLUSIONS:

As a result of this study seven major general duties of the superintendent of schools were recognized. Stated in order of frequency of mention of the problems identified, they are:

1. The proper development of the school curriculum in which every attempt is made to meet the needs of individual pupils.
2. The development of a well balanced program of public relations based upon a philosophy of education that may be understood by the public, the pupils, the staff, the board of education, and the citizens supporting the school.
3. The management of personnel which will produce an effective working organization, an organization in which supervision will produce cooperation and support for the school program, an organization in which teacher welfare is considered essential and will produce effective teaching.
4. The working with the board of education to produce an adequate educational program for people of the community of all ages. The securing of reasonable rules and regulations, sound educational policy, and proper administrative relationships are some of the objectives in working with the board of education.
5. The welfare and happiness of the pupils who attend the schools is a duty not to be overlooked. It requires the superintendent to provide for adequate pupil accounting and to concern himself with individual pupil needs.
6. The providing for and supervision of a pupil activity program both of a general and of an athletic nature is a function of the superintendent of schools.
7. The management of school property - plant, equipment, supplies, textbooks, and library books - is the seventh function of the superintendent of schools.

In addition, it was found that all superintendents were faced with relatively similar problems and duties. Little

difference in this respect was found between superintendents with varying degrees of experience; likewise, superintendents working in different types of districts appeared to be faced with the same or similar problems and duties.

The findings in this study seemed to indicate that the problems of the superintendent of schools, involving the duties of his position, cover a wide range and are extremely varied. In the reading of literature on school administration, one seems to get the impression that superintendents are confining their efforts chiefly to problems in school finance, school buildings, and school business. This study would cause one to believe that problems in school curriculum, school public relations, and school personnel should be among the principal fields of concern to superintendents. 213 pages. \$2.80. Mic 56-3294

#### PROBLEMS OF SCHOOLING SLOW LEARNING SENIOR HIGH SCHOOL STUDENTS

(Publication No. 17,160)

Herman T. Lenser, Ed.D.  
Wayne University, 1956

Adviser: Dr. William Reitz

PURPOSE: The purpose of this study was to investigate selected literature and school practices relating to the education of slow learning senior high school students with Intelligence Quotients from fifty to ninety including retarded and borderline groups.

METHODOLOGY: Conclusions were secured from three sources: (1) The survey of selected literature, (2) The status study of 420 slow learning senior high school students of Detroit, by means of a check list of seventy-nine items based upon the files of the Psychological Clinic and the Department of Special Education, and (3) The follow-up study of 420 slow learning senior high school students of Detroit, based upon a questionnaire of twenty items sent directly to them.

GENERAL CONCLUSIONS: (1) This study affirms the belief that special provisions for slow learners do promote pupil growth. The status study of 420 senior high school Special Preparatory students of Detroit indicates that these slow learners made educational progress in school but at a less than normal rate. The after school summary indicates that senior high school preparatory students do become self-supporting responsible citizens and are not wards of the state. (2) The survey of the literature and the practices of the school systems indicate that a program of education for slow learners should place its major emphasis upon a high school program of vocational education and social skills which are functional and practical to the individual. (3) The cost of providing special education services is high because of the small size of special classes, but the cost to society is nil when students of special education classes become self-supporting citizens.

RECOMMENDATIONS: These recommendations for education are based upon the implications of this study: (1) That classroom space be provided in each new senior high school erected in order to assure space for slow learning students. (2) That more on-the-job and school-work training programs be provided. (3) That a coordinator

or counselor especially trained to work with slow learners be provided in every school system to assure placement and follow-up services for these students. (4) That more curriculum materials at the reading and interest levels of slow learners be produced. (5) That the special education curriculum be extended into or through the senior high school. (6) That more teachers who are interested in slow learners be trained. (7) That school personnel, lay organizations, and community agencies be enlisted in the long-term planning of special education programs in order to better understand them and their need for more adequate financing. (8) That more parent organizations, similar to the one in Detroit, be organized to study problems relating to slow learning students.

230 pages. \$3.00. Mic 56-3295

**A STUDY OF THE CURATORS FRESHMAN SCHOLARSHIP AND AWARD STUDENTS AND THEIR SUCCESS IN THE UNIVERSITY OF MISSOURI, 1950-1954**

(Publication No. 17,904)

Robert Justin Letson, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. John Rufi

**Purpose:** The major purpose of the study was to describe the students who had entered the University of Missouri with Curators Freshman Scholarships or Awards during the five-year period, 1950-54, and to investigate their success in the University.

**Method of Research:** Data for the study were secured from the following sources: the minutes of the Board of Curators and official records of the Admissions Office, the Missouri College Aptitude Testing Service, and the University Counseling Bureau.

**Summary:** Curators Awards were made available to students on the bases of high school percentile rank, Ohio test scores, and financial need. Curators Scholarships were made available to the student of highest scholastic promise in each Missouri high school selected on the basis of a combination of high school percentile rank and Ohio test score. During the five-year period studied, 809 Award and 216 Scholarship students had entered the University under this program.

Compared to other University students, both the Award group and the Scholarship group contained a higher percentage of women and a larger proportion of graduates from the medium and small sized high schools. Award students were found to come from a somewhat lower socio-economic level. The Award students and the Scholarship students were found to be markedly superior to other University students with respect to high school percentile rank and scores on the Ohio test, the American Council on Education test, and The Cooperative English Tests A and B2.

The Award students and the Scholarship students were found to be markedly superior to other University students in all measures of scholastic achievement studied. These measures included: first semester grade-point average, making the honor lists, persistence in attendance, and total grade-point average.

Distinct relationships were found to exist between performance on the selective criteria--high school percentile rank and Ohio test scores--and the following evidences of scholastic achievement: first semester grade-point average, the maintenance of an average of 200 or above, and making the honor lists. Only slight relationship existed between performance on the criteria and persistence in attendance. In all comparisons high school percentile rank was found to be more closely associated with scholastic achievement than was Ohio test score.

Scholarship students were found to rank significantly higher than Award students in high school percentile rank and on the Ohio test, the American Council on Education test, and The Cooperative English Tests A and B2. Scholarship students were also found to rank significantly higher than Award students with respect to first semester grade-point average, making the honor lists, and total grade-point average. No significant differences were found between the two groups in their persistence in attendance.

**Major Conclusions:** For the Scholarship and Award groups as a whole the procedures used appeared to have been effective in selecting worthy students. These students have merited the confidence placed in them, and the expenditure on the part of the Board of Curators appears to be justifiable.

The level of scholastic achievement of the Award and Scholarship students could have been increased by raising the requirement levels on the selective criteria, especially on high school percentile rank.

The significantly higher performance of the Scholarship students would appear to justify the establishment of the two types of grants.

246 pages. \$3.20. Mic 56-3296

**THE ADMINISTRATION OF CONSERVATION COURSES IN CERTAIN SECONDARY SCHOOLS IN THE UNITED STATES**

(Publication No. 18,589)

Henry Arthur O'Connor, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. A. G. Capps

**Purpose:** To present some of the administrative factors of Conservation Courses offered in certain secondary schools in the United States. A secondary purpose was to show the extent to which colleges and universities were offering courses in Conservation, since these institutions have some influence on the offerings of the secondary schools and on the training of Conservation teachers.

**Method of Research:** The data were obtained chiefly from (1) letters from the chief state school officials in the forty-eight states, (2) information blanks concerning the administration of specific courses in Conservation, and (3) catalogues and bulletins of major colleges and universities.

**Summary:**

(1) The majority of secondary schools in this study were

four year high schools located in the north central and central regions of the United States.

(2) The average enrollment per class section in the Conservation Courses was twenty-five students. Student interest rather than their rural or urban background was the motivating factor for enrolling in these courses.

(3) The courses had been offered for an average of seven years.

(4) School administrators were chiefly responsible for introducing these courses.

(5) Supervision and revision of the courses were the responsibilities of the instructors rather than the State Education Agencies or local faculty committees.

(6) In 91 per cent of the schools these courses were offered on a full semester basis requiring daily class meetings. The credit allowed was acceptable for college entrance requirements in 86 per cent of the schools.

(7) These courses were elective rather than required in 83 per cent of the schools and in almost half the schools were restricted to junior and senior students. Prerequisite courses were seldom required.

(8) The majority of the schools considered these courses as general education, approached from the standpoint of the natural resources of the United States.

(9) Schools undertaking field trips averaged eight per course and a majority had definite administrative policies for excusing students for these trips.

(10) The majority of schools used Conservation textbooks and maintained Conservation reference libraries.

(11) School forests, the surrounding community, films, and filmstrips were used extensively as course supplements. State Conservation Commissions contributed a great deal of material and personnel services.

(12) The local school districts were responsible for the over-all financing of these courses. A majority of the schools provided: (a) transportation for field trips, (b) insurance fees for students on field trips if accident insurance was in effect, and (c) textbooks if texts were used. The average sum expended annually in schools reporting operational expenditures for the course was \$255.88.

(13) Conservation teachers' salaries were comparable to salaries of other staff members.

(14) The majority of Conservation teachers had academic training in Conservation. A course in the Methods of Teaching Conservation was neither required nor recommended for education majors in most states.

(15) Teaching requirements most frequently mentioned for Conservation Courses were course work in Conservation or a major in biological science.

(16) Many colleges and universities were offering selected study in Conservation. Conservation courses were offered most frequently in the geography department and under the college of arts and science of these institutions. Prerequisite courses were seldom required.

(17) Few colleges offered courses specifically for teacher preparation in the field of Conservation.

**Observations:**

- (1) School administrators should consider the surrounding community and a school forest as possible facilities for supplementing a Conservation Course.
- (2) Assistance from the State Conservation Commissions for this course offering should not be overlooked.
- (3) Teachers desiring training in Conservation may now receive this training in colleges and universities.
- (4) The Conservation Course is well accepted in the secondary schools where it is offered. Although a relative newcomer to the secondary education it has the support of the students, the teachers, the administrators, and the community.

211 pages. \$2.75. Mic 56-3297

**A STUDY OF THE STATE SCHOLARSHIP AID PROGRAM FOR NEGROES IN GEORGIA, 1944-1955**

(Publication No. 19,394)

William Broughton Pirkle, Ed.D.  
Alabama Polytechnic Institute, 1956

Chairman: Raymond H. White

**THE PROBLEM**

The purpose of this study was to collect and organize data related to the scholarship aid program for higher education of Negroes in Georgia, 1944-1955, in order to evaluate pertinent phases of this program.

By a thorough investigation, the writer failed to find a closely related study in this field.

Specific purposes were to formulate objective answers to questions regarding the (1) background of the dual school system in Georgia; (2) policies governing the program; (3) method of operation; (4) cost of the program; (5) number of recipients; (6) frequency and total number of grants; (7) fields of study pursued; (8) number, type, and location of colleges attended; (9) quality of work done; (10) geographic residence of recipients; (11) terms attended; (12) degrees sought; (13) occupations of recipients at the time of initial grants; (14) contributions made by recipients as professional practitioners.

The ultimate concern was to determine the implications derived from these data.

**PROCEDURE**

The descriptive-survey method was used to interpret the records of the Board of Regents of the University System of Georgia. These records were the main source of data.

**FINDINGS AND CONCLUSIONS**

1. The dual school system in Georgia is deep-rooted.
2. No provisions were made for graduate and professional education of Negroes prior to 1943 when the scholarship program was inaugurated.

3. Requirements for a grant are: (a) a citizen of Georgia; (b) a Negro; (c) admitted to an approved institution; and (d) pursuing a course which is offered to white citizens in state institutions but not offered in the state Negro institutions.

4. The amount of the grant is the difference in cost between state institutions and those attended by the recipients. Grants are made for a quarter or a semester. The number of renewals is limitless if the student's work is satisfactory.

5. All states with dual school systems have operated an out-of-state aid program.

6. The cost in Georgia rose from \$1,044.00 in 1944 to \$208,217.90 in 1955.

7. There were 5 recipients in 1944 and 1,790 in 1955; 5,118 different recipients received 13,437 grants.

8. Recipients attended 121 colleges located in 30 states and pursued 92 fields of study.

9. Recipients were drawn from 138 of the 159 counties in Georgia.

10. Recipients sought successfully the bachelor's, master's, doctor's, and medical degrees.

11. There was evidence that many recipients in the fields of law, medicine, pharmacy, dentistry, and teaching are contributing their services to the citizens of Georgia.

The following recommendations are made:

1. That the scholarship aid program be continued.
2. That the present policies and procedures be used.
3. That graduate programs be offered at two centers within the state.

4. That the programs in the three state-operated colleges for Negroes be expanded.

5. That the Board of Regents continue its relationship with the Southern Regional Education Board.

6. That further studies concerned with the scholarship aid program be made. These should include (a) an evaluation of the state aid program in which recipients are used as subjects; (b) the ability of the state to finance an adequate program of education; (c) a comparative study of the cost of providing education by out-of-state grants with the cost of providing education in state-operated institutions; (d) a study based on projected enrollments.

208 pages. \$2.70. Mic 56-3298

#### A STUDY OF THE FUNCTIONS AND PROCEDURES OF SELECTED 1955 WISCONSIN ANNUAL SCHOOL DISTRICT MEETINGS

(Publication No. 19,129)

Anthony Wayne Randolph, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Glen G. Eye

The purpose of this study was to investigate the functions and procedures of the annual school district meetings of Wisconsin in 1955. The annual meeting is held once each year by the legal voters of each district at a regularly and legally designated time. All voters are eligible to attend and participate in the exercise of the powers and duties enumerated in the state statutes.

The basic data were obtained from (a) the recorded minutes of the 1955 meeting in each school district studied;

(b) historical documents; (c) the official communications issued from the offices of the county and state superintendents of schools; (d) court decisions; (e) school codes of Wisconsin; and (f) an interview-questionnaire conducted among selected lay and professional people in each district.

Four types of districts were selected in each of five counties. The types were as follows: (1) one-room school districts; (2) elementary districts with two to eight teachers; (3) elementary districts with nine or more teachers; and (4) districts offering a twelve year program with nine or more teachers.

The data indicated that the current methods used in announcing the annual meeting dates are no longer effective for over two-thirds of the voters.

On an average less than one person in 10 attends the annual meeting. The size of the school districts, other than in the one-room districts, made little difference in the per cent of the people attending the meetings. There was conclusive evidence that a major portion of the attendance in each meeting consisted of a small nucleus of regular attenders who had a mutual special interest and often a confidential understanding regarding the decisions of the meetings. Most of the people not attending the meetings are disinterested in the meetings.

In the districts with less than eight teachers the annual meeting decisions represented the major portion of the administrative decisions for the term. The administrative control by the people decreased as the school administrators received greater recognition as leaders and authorities on educational problems.

There was evidence of a struggle for power between the school board and other interviewees. Those interviewed who were not board members were in agreement that no additional powers should be granted to school boards and conversely no school board members favored any transfer of their powers to the annual meeting.

There is no tendency on the part of most people to favor the elimination of the annual meeting as an instrument of democratic public school administration. There was no conclusive evidence to prove that any single district type provided for any more favorable meeting conditions than any of the other district types.

There is substantial evidence that the processes used in making decisions at the annual meeting are not conducive to free and active discussion and participation by all of the people.

Major improvements suggested by the interviewees fell into the following categories:

1. The general tone of the meetings and the effectiveness of the meeting procedures should be improved.
2. A greater amount of pertinent information relative to the whole process of conducting the annual meeting should be made available to the voters.
3. Greater attendance at the meeting and more active democratic participation of those attending the meetings should be encouraged and planned.
4. Provisions should be made for more varied and effective publicity with respect to the dates and the significances of the meeting.
5. The election policies and the process of selection of school board members should be improved.
6. The date of the annual meeting should be changed.

In general many people do not fully understand or take advantage of the annual meeting as much as they think they should.

281 pages. \$3.65. Mic 56-3299

**A STUDY OF ASSESSMENT PRACTICES IN TENNESSEE AND THEIR IMPLICATION FOR THE FINANCING OF PUBLIC EDUCATION**

(Publication No. 19,292)

Harold Franklyn Rowe, Ed.D.  
The University of Tennessee, 1956

Major Professor: John W. Gilliland

**Purpose.** The specific problem of concern in this study was the determination of assessment practices in Tennessee and their implications for public school financing. The following phases of the total problem were given specific consideration: (1) current procedures for financing public education in Tennessee, (2) current procedures of assessment in Tennessee, and (3) the implications of current assessment practices upon current procedures for financing public education in Tennessee.

**Procedures.** Three distinct steps were followed in carrying out this study: (1) the current situation in Tennessee with respect to financial support for public schools was set forth in a succinct manner, (2) the important considerations relating to assessment practices were set forth, and (3) an analysis of the current plan for financing education, together with assessment practices in Tennessee, and assessment practices in general, was made to help determine the implications of assessment practices for public school financing.

**Findings.** The implications which seemed to emerge were: (1) The state and local governments might appropriately enter into a partnership arrangement for assessing local property. (2) More adequate assessment of local property within the framework of a state assistance program would tend to increase local revenue, enabling many counties to go beyond the minimum program. (3) More adequate assessment of local property would tend to enable local units to accept some increased costs of education, which the state may not be able to bear. (4) Increased local contributions toward support of public education would tend to result in more adequate financing in general. (5) Increased local support which might accrue from improved assessment practices would tend to add some degree of stability to the total finance plan.

**Recommendations.** The recommendations were as follows:

1. It was recommended that a competent study of local assessment procedures and problems be made.
2. That the legislature be advised regarding the results of that study.
3. It was further recommended that a system be set up for continuous study of assessment problems. A report of the results of these studies should be made regularly to the legislature, in order that continuous implementation of any program for improvement will be made.
4. It was recommended that the local system's percentage of assessment and the rate of levy imposed should be adequate to provide the funds necessary to support the

quality of schools beyond the minimum program which the people desire.

5. That the legislature enact laws requiring a uniform system of scientific and impartial valuation, and that machinery should be set up to insure such assessments being made in accordance with the law. In line with the above recommendation one final recommendation seemed to emerge. Namely, that the legislature create a state agency that would be required to prescribe a uniform state-wide assessment procedure and standardized valuation, and empower the agency to see that these procedures are enforced in all counties alike.

184 pages. \$2.40. Mic 56-3300

**FACTORS INFLUENCING THE MORALE OF ELEMENTARY SCHOOL PRINCIPALS IN CENTRAL ILLINOIS**

(Publication No. 18,725)

Robert E. Walters, Ed.D.  
Bradley University, 1956

This study was made for the purpose of determining some of the common factors which help to raise or lower the morale of the elementary school principals in forty-four counties in Central Illinois. Morale is interpreted as a "mental state of well-being and may be recognized at different levels of satisfaction." Morale is deemed important in the retention of elementary administrators on the job.

The study was made of the survey type, with a questionnaire being distributed to 764 principals in the counties mentioned above. Approximately 60 per cent were completed and returned.

The morale of the elementary administrator is discussed under such headings as (1) administration, (2) extracurricular activities, (3) personal problems, (4) public relations, (5) professional responsibilities, (6) parent-teacher relations, (7) supervision, (8) pupil transportation, (9) relations with the superintendent's office, (10) school board-principal relations, and (11) teacher-pupil relations.

Various subtopics under these eleven are investigated and discussed. All principals are divided into two major divisions; principal-superintendents, and building principals. These are further subdivided and analyzed according to size of school enrollments and presence of outside income. The outstanding positive and negative factors are listed for each group. An overview of all principals, as a group, is given.

Each chapter contains a summary, and a summation chapter is included concerning the major aspects of the study.

145 pages. \$1.95. Mic 56-3301

**EDUCATION, ADULT****PROBLEM-SOLVING PROCESSES IN ADULT GROUPS**  
(Publication No. 18,375)

Rolland David Berger, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Burton Kreitlow

It is the purpose of this investigation to identify as many components as possible which should be included in a proper description of group problem-solving processes.

The study attempts to identify the principal components in a description of group problem-solving processes by carefully examining and reporting five case studies: a farm improvement program, a school district integration, an industrial development program, the building of a community center, and a migrant worker program. The insights gained from these case studies are integrated with a review of the literature and insights gained from interviews with group problem-solving specialists.

The following descriptive outline resulted from this study and the description of group problem-solving processes takes form within it:

- I. Understanding the nature of the problem and its setting as a basis for understanding group problem-solving processes.
  - A. The nature of the problem.
    1. To what extent is it a controversial problem?
    2. To what extent is there a known solution to the problem?
    3. What is the magnitude of the problem?
    4. Who are the beneficiaries of the solution to the problem?
    5. To what extent are the beneficiaries of the solution to the problem able to act in their own behalf?
    6. How much time is required to obtain a solution to the problem?
    7. To what extent is the solution of a given problem one of degree as contrasted to complete accomplishment of a goal?
  - B. The setting of the problem.
    1. To what extent is the problem a part of a larger problem?
    2. To what extent must related problems be solved to insure the solution of a given problem?
    3. To what extent do social-cultural considerations influence the solution to a problem?
    4. To what extent do the people involved in problem-solving have a sense of freedom and security within the problem-solving framework?
    5. To what extent is there a climate favorable or unfavorable to the solution of a given problem?
    6. To what extent have recent happenings inclined people toward action or lack of action?
- II. Understanding the nature of the group and membership of the group as a part of understanding group problem-solving processes.
  - A. The nature of the group or groups.
    1. How organized.
    2. Number of groups involved.
    3. Vitality and cohesiveness.
    4. Life cycle.
    5. Size.
    6. Acceptance of action responsibility.
    7. Purposes and goals.
    8. External and internal system.
    9. Inter-group relations.
    10. Motivation.
    11. Sub-groups.
    12. Fabric of authority.
    13. Patterns of co-operation.
  - B. Group membership.

1. Leadership roles.
2. Capabilities of group members.
3. Concern for problem.
4. Barriers within the individual.
5. Individual and group relationships.

**III. The nature of group problem-solving processes.**

- A. Recognizing and defining problems.
- B. Getting the background for decisions on problems.
- C. Obtaining decisions in group problem-solving.
- D. Translating a group decision into action.
- E. Evaluating the results of group action.
- F. Interrelationships within the group problem-solving processes.

The investigation points up the need for additional case studies chosen on the basis of different criteria from those presented in this thesis. It establishes the need for a standard reporting form for group problem-solving case studies based on the results of this and subsequent investigations. Such a reporting form would greatly aid in communication among investigators.

115 pages. \$1.50. Mic 56-3302

**COMMUNITY STUDY AS A BASIS FOR PROGRAM PLANNING IN ADULT EDUCATION**

(Publication No. 18,670)

Samuel E. Hand, Ed.D.  
The Florida State University, 1956

This study was made for the purpose of providing information and help to local adult educators in the study of their communities for program planning purposes. It traces the evolution of the concept of community through the writings of various social scientists, and reviews in some detail current meanings and concepts. It examines the relationship of the individual and the community, giving particular attention to the ways in which the community influences the development of the human personality. It reviews the purposes and benefits of community study for the adult educator.

The final phase of the study is devoted to the formulation of an approach to community study specifically for adult education program planning. Thirty-four published guides to community study were analyzed. Fifteen of these were of a general nature, comprehensive in scope, while nineteen were for a limited or special purpose. In all of the general guides examined, certain elements of community were included as essential for study: (a) the historical background and physical setting of the community, (b) the people, (c) the economic structure, and (d) the functional operations. With these as the basic areas, an outline was prepared which delineates the kinds of information and data within each area which have significance for adult education program planning.

The essentiality of community study as a fundamental prerequisite to the planning of socially useful programs of adult education was found to rest on the following factors: (a) the responsibility of adult education in the development of responsible democratic citizens; (b) the pervasiveness of the community's influence on the development of the individual personality; (c) the differences between communities; (d) the dependence of a democratic society upon citizen participation; and (e) the fact that the great social

problems of our time are reflected in and can best be understood and attacked within the community context.

The study concludes that certain principles of operation should guide the adult educator in his relationships with the community: (1) local programs of adult education should grow out of the cultural patterns of their individual communities; (2) adult education programs should be tailored to and fitted within the social structure of their communities; (3) the values which guide the development of an adult education program must be consistent with the enlightened values represented in the community and the society of which it is a part; (4) the content of educational activities for adults must be determined by the individual needs of the participants, within the context of the overriding needs of the community; (5) the methodology of adult education must be consistent with the principles governing a democratically conceived adult society; (6) an adult education program must be devoted to the enhancement of enlightened citizen participation; (7) the adult education program must grow out of the cooperative thinking and planning of the participants and the educational agents; and (8) in any adult activity involving the community, whether it be for adult education alone or for any other form of human endeavor, every element of the community must be assured an opportunity to participate in both the planning and the action.

128 pages. \$1.70. Mic 56-3303

#### AN ANALYSIS OF THE IMPORTANCE OF FORMAT TO EDUCATIONAL TELEVISION PROGRAMS

(Publication No. 17,352)

Richard Henry Williams, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Walter A. Wittich

This study analyzes the importance of format to educational television programs. A two part problem faces the producer of educational television programs. He must insure: (a) that the desired information is presented and, (b) that the method of presentation is sufficiently interesting to command a viewing public. The basis of analysis, then, is the factors of interest in; and, information gained from an educational television program.

Four selected formats of a single educational television program were analyzed. The program was a presentation of the seven steps in effective utilization of the 16 mm film. Two leaders in the area of audio-visual education each made a set of four kinescope recordings of the formats. The formats were:

1. Expert alone discussing effective utilization of the 16 mm film;
2. Expert demonstrating with fifth and sixth grade children effective utilization of the 16 mm films;
3. Expert and two parents discussing effective utilization of the 16 mm film; and,
4. Expert and a teacher and a school administrator discussing effective utilization of the 16 mm film.

An effort was made to control as many potential vari-

ables in the programs as possible. The attempt at control was exercised in the following ways:

1. the seven steps in the effective utilization of the 16 mm film served as content in all four programs;
2. two experts were used to nullify the possible instructional variable of a single expert;
3. different parents, teachers, administrators and children were used in each of the two sets of kinescopes;
4. each individual program was designed to run 14 minutes and 45 seconds;
5. each expert made a four minute kinescope recording which served to introduce the four programs;
6. in all programs a film clip from an existing 16 mm educational film was used, each clip was judged to make a similar contribution; and,
7. the same studio settings were used for like programs by each expert.

The format was the major variable between the programs in each set of four kinescope recordings.

The total population was divided into two experimental groups: (a) parents, and (b) teachers. Each set of four programs was shown, in a different sequence, to four groups of parents and to four groups of teachers. Thus any possible sequence variable was rotated out.

The data collected allowed a two fold analysis of each of the factors.

Interest factor:

1. a forced rank (no ties) of the formats on a one to four scale; and,
2. the recording of fluctuation in interest on an audience response device.

Information factor:

1. a forced rank (no ties) of the formats on a one to four scale; and,
2. two points of information about the content were written after each program was shown.

The hypothesis tested is that there is no measurable difference in audience reaction, based on interest in and information gained factors, to four selected formats of a single educational television program. The statistical techniques used were: (a) the rank-difference correlation technique for analyzing the two sets of ranks made by each experimental group, and (b) the analysis of variance technique to analyze the audience response meter readings.

The total experimental population ranked the formats as follows:

Interest:

- (1) expert-children, (2) expert-parents, (3) expert-teacher, (4) expert alone

Information

- (1) expert-teacher, (2) expert-children, (3) expert alone, (4) expert-parents

The analysis of the audience response meter readings showed:

1. no significant differences between the means of the experimental groups; the two experts; the group-experts interaction; the group-method interaction;

experts-method interaction, or groups-experts-method interaction;

2. significant differences between the means of the sum of squares for the four formats.

The hypothesis is rejected on both factors. There is a measurable difference in audience reaction, based on interest in and information gained factors, to four selected formats of a single educational television program.

281 pages. \$3.65. Mic 56-3304

## EDUCATION, HISTORY

### AN HISTORICAL AND ANALYTICAL STUDY OF THE TALLY, THE KNOTTED CORD, THE FINGERS, AND THE ABACUS

(Publication No. 18,769)

Julia Elizabeth Adkins, Ph.D.  
The Ohio State University, 1956

Purposes. The purposes of the study were: (1) to investigate man's use of physical devices through the ages, especially the tally, knotted cord, fingers, and abacus, as a means of recording and communicating numbers and of computing with numbers; and (2) to survey briefly the trends and practices of the schools (from ca. 600 B.C. to the present) in the teaching of arithmetic in relation to the use of objective materials.

Procedure. In order to achieve the purposes listed, an examination and analysis were made of a wide sampling of pertinent research studies, books, and periodicals.

Findings. Evidence indicates that in the Neolithic Age man reached that stage in his development in which he became a herdsman. As he accumulated possessions, he needed a technique which would enable him to record numbers, to communicate numbers, and to compute with numbers.

For these purposes he began using materials around him that were plentiful and convenient, such as pebbles, sticks, shells, and berries. He also discovered that his own fingers served as an effective means of representing and communicating numbers, and even of computing with numbers. As man acquired new skills and learned to make rope or cord, he began to use this material for a more permanent form of record-keeping.

At first, most peoples used these materials as forms of tallies. By the definition adopted in the study, an object or a mark is called a tally if the following conditions are met:

1. A matching in one-to-one correspondence. An illustration of this use is the matching of one tally-object, such as a pebble, a finger, or a knot in a cord, with one of the objects being counted, or a matching of one tally-object with one group of objects.

2. An absence of the use of place value. When man became intellectually capable of grasping the idea of place value, he devised an instrument which is called an abacus. In the study the basic condition set up for classifying a device as an abacus is that the principle of place value be employed.

Various types of abaci were developed which differed in structure and in materials. These proved to be so efficient that the introduction of the Hindu-Arabic numerals was resisted, and the Western world used an abacus until the sixteenth century. It is still being used in Russia and in Oriental countries, such as China and Japan.

Physical devices used by adults as commonly as the four discussed in the present study became the basis for the teaching of arithmetic to children in the schools during the various periods in history. Surprising as it may seem, arithmetic has been taught more years without the Hindu-Arabic numerals than with them. For over two thousand years (ca. 600 B.C. to the 16th century A.D.) arithmetic for the school child consisted almost entirely of learning the use of some form of physical device. It is only within the last three or four centuries that facility in the use of the Hindu-Arabic numerals has become one of the goals in the teaching of arithmetic in the Western world.

Pedagogic Suggestions. Even though the present study is primarily historical in nature and not experimental, the experience of the past may serve to point the way to the future. On the basis of this experience, a sequence of activities for the teaching of arithmetic is suggested, planned so as to provide a gradual transition from unstructured forms of tally-objects to a structured abacus, and finally to the abstract Hindu-Arabic numerals.

346 pages. \$4.45. Mic 56-3305

### A HISTORY OF THE UNIVERSITY OF NEWARK, 1908-1946

(Publication No. 17,634)

Hugh Francis Bennett, Ph.D.  
New York University, 1956

On July 1, 1946, The University of Newark, with its fully accredited schools of law and business administration and a fully accredited college of arts and sciences, became part of Rutgers University, the State University of New Jersey. Prior to this time Rutgers had neither a law school nor a school of business administration. The three schools were significant additions to the state university and before becoming part of public higher education in Rutgers, they and their predecessors played an important role in private and proprietary higher education in New Jersey.

The University of Newark, as finally constituted, had a separate existence of only ten years (1936-1946). It resulted from the merger of a group of three schools, New Jersey Law School (1908-1936), Seth Boyden School of Business (1929-1936), and Dana College (1927-1930 as the Pre-legal Department of New Jersey Law School - thereafter as Dana College until 1936), and two other schools which since 1934 had been incorporated as the University of Newark (Newark Institute of Arts and Sciences 1909-1936 and Mercer Beasley School of Law 1926-1936).

Two of these schools, New Jersey Law School and Seth Boyden School of Business were proprietary schools until 1933, at which time the trustees of Dana College bought out the interests of the owner, Richard D. Currier, truly a captain of erudition. The predecessor of Dana College, the Pre-legal Department of New Jersey Law School (1927-1930)

was also owned by Currier. Thus not only has the State University of New Jersey developed on the structure of Rutgers University, a private and colonial institution, but it has also a proprietary background.

The historical method was employed in the preparation of this dissertation. Source material investigated included the following:

A. The Acts of Incorporation of 1. The predecessor institutions, 2. The "University of Newark" 1934, 3. The University of Newark 1936;

B. The merger agreements of 1. The attempted merger of Dana College with Rutgers in 1933, 2. The merger of Mercer Beasley and Newark Institute in 1934, 3. The merger of the Mercer Beasley-Newark Institute group with the New Jersey Law School-Dana College-Seth Boyden group in 1936, 4. The merger of the University of Newark and Rutgers University of 1946;

C. The "cooperative arrangement" agreements with New York University during 1909-1939;

D. The Faculty Minutes of 1. The predecessor institutions, 2. The schools and colleges of the University of Newark, 3. The cooperating schools and colleges of New York University;

E. The Minutes of the Meetings of the Trustees of 1. The predecessor institutions, 2. The University of Newark, 3. Rutgers University;

F. The edited catalogues and bulletins of 1. The predecessor institutions, 2. The schools and colleges of the University of Newark, 3. The cooperating schools and colleges of New York University;

G. Financial records of the institutions under study;

H. Newspaper files for the period 1900 to 1946;

I. Student newspapers and publications of the predecessor institutions and the University of Newark;

J. General Histories of the City of Newark;

K. General Histories of the State of New Jersey;

L. Studies in the history of the growth of the educational system of the City of Newark;

M. Academic records of students in all of the institutions under study;

N. Studies, in being or in progress, of educational institutions now or previously local to the City of Newark or to the State of New Jersey.

262 pages. \$3.40. Mic 56-3306

#### THE DEVELOPMENT OF THE LAND-GRANT COLLEGES: THEIR PROGRAM AND PHILOSOPHY

(Publication No. 18,272)

Edward Danforth Eddy Jr., Ph.D.  
Cornell University, 1956

This study deals with the origin and development of the sixty-nine American colleges and universities receiving benefits from the Morrill Act of 1862 and subsequent Federal legislation relating to this act. The institutions are examined in terms of the historical development of their program and philosophy. The source material includes histories of the colleges, educational histories, Proceedings of the American Association of Land-Grant Colleges and State Universities, and individual speeches and statements of aims.

An examination is first made of the educational movements in America in the first half of the nineteenth century, leading to the founding of the new colleges. The thinking regarding the need for agricultural and industrial education at mid-century is explored, followed by a review of the provisions of the Morrill Act which formed a charter for the colleges. Their group history is then related in chapters devoted to chronological periods of development. The first period begins with the establishment of the colleges and extends to 1879; then from 1880 to the turn of the century; from 1900 to the passage of the Smith-Lever Act in 1914; from the First World War through the depression of the thirties; thence to the modern day. A separate chapter is devoted to the seventeen colleges established primarily for the education of Negroes inasmuch as the history of these institutions differs in time and conditions from the remaining fifty-two colleges. A final summary is given of the philosophy of the land-grant institutions, together with some conclusions regarding their development.

The attempt is made to show how the colleges responded to national needs and changes, particularly in the establishment of research and extension activities. They are shown originally as "vocational schools," depending on the older classical colleges for subject-matter until new fields and techniques for teaching could be evolved. Their emergence as universities in form and function is described through an examination of the development of their program. In particular, emphasis is given to the contribution they have made to American life and to American education, as a result of their stress on instruction, research, and extension work in agriculture, home economics, engineering, and veterinary medicine, as well as their attempts to live by the Morrill Act provision for "military tactics." In each case, new Federal legislation affecting the colleges is examined for its provisions and stimulus to new fields of effort. The relationship of the colleges to the states as publicly supported institutions is explored.

The development of the Land-Grant Colleges and Universities is shown as the result of evolution rather than of primary vision. The general conclusion is that the institutions have become a distinct and unique form of American education by their program division into the three fields of instruction, research, and extension, and by the emergence of a "social consciousness" which has permeated all of their work. Their influence in a widening of the traditional college curriculum, in the equality given to various fields of study, in the fashioning of new functions for higher education, and in the democratization of education through expanded opportunity is demonstrated by the history of their first hundred years.

672 pages. \$8.50. Mic 56-3307

**THE TEACHING OF SPEECH AND BY SPEECH  
IN PUBLIC RESIDENTIAL SCHOOLS FOR THE  
DEAF IN THE UNITED STATES, 1815-1955**

(Publication No. 17,819)

Hugo Frederick Schunhoff, Ed.D.  
University of Maryland, 1956

Supervisor: Professor Alvin W. Schindler

The study is concerned with the presentation of a concise, chronological record of the growth of the teaching of speech and by speech in public residential schools for the deaf in the United States from the opening of the first school for the deaf in Virginia, in 1815, and the establishment of the first permanent, free public school for the deaf in Hartford, Connecticut, in 1817, until 1955. The study consists of two parts. Part one deals with historical findings revealed by a study of the literature. Part two is a questionnaire study of the status in 1954-55.

The first regular teacher of the deaf in Europe, Pedro Ponce de Leon, in the sixteenth century, taught speech. As the instruction of deaf children progressed in Europe, a controversy arose over methods, speech opposed to manual language. This controversy was carried into the United States.

When Thomas Hopkins Gallaudet, who became head of the first permanent school, now the American School for the Deaf, Hartford, Connecticut, went to Europe to learn how to teach the deaf, he brought back the French method, which employed manual language, rather than the oral methods of England and Germany. However, speech was taught from the beginning in a limited manner to certain pupils with residual hearing and to those who had recently become deaf. Miss Eliza Wadsworth, in the American School, in 1857, became the first regular full-time teacher of speech in schools for the deaf in the United States.

The year, 1867, marked the founding of two oral, public, residential schools for the deaf in the United States. These schools are known today as the Lexington School for the Deaf, New York City, and the Clarke School for the Deaf, Northampton, Massachusetts. The influence of these schools, together with the impetus of the discussions at the first meeting of the Conference of Superintendents and Principals in 1868 resulted in a period of tremendous growth in speech instruction.

Contributions and events of significance between 1868 and 1900 included Alexander Graham Bell's work with Visible Speech, J. A. Gillespie's work with residual hearing, Z. F. Westervelt's combined method using finger spelling with speech, the organization of articulation teachers by founding the American Association to Promote the Teaching of Speech to the Deaf, the heated debates and misunderstandings between professional leaders, and the beginning of the combined system in a majority of the public residential schools. (The combined system is a program which provides oral classes and non-oral classes in the same school, fitting the method to the child.)

Significant quantitative gains continued until about 1920. The emphasis soon changed to that of a quest for better speech, the greatest single contribution being the impact of electronic amplification.

From the questionnaire, it was found for the year, 1954-55, in public residential schools reporting, that 55.9 per cent of the pupils received all instruction by speech,

38.6 per cent were taught by speech and manual methods, and 5.5 per cent received no speech instruction.

187 pages. \$2.45. Mic 56-3308

**SOME FACTORS IN THE DEVELOPMENT OF  
THE CONCEPT OF LOCAL CONTROL AND  
ITS APPLICATION TO PUBLIC EDUCATION  
IN MISSOURI**

(Publication No. 18,593)

Robert Howard Steinkellner, Ed.D.  
University of Missouri, 1956

- (1) Early in his developmental process man recognized that there was need to perpetuate his experiences. Man created institutions for varied reasons. Some of the institutions, such as Church and State, dominated the masses of humanity for centuries, and the formal educational process was restricted to the few. Many men were subjected to slavery, serfdom, and subjugated by ignorance.
- (2) Eventually, man evolved and created a form of government wherein control by the people of the formal educational process for all the people was permissible. During its formative stages American culture was influenced principally by the English culture.
- (3) In the United States, the Constitution and the Bill of Rights insured that sovereign power was vested in the people. The Constitutions of Missouri reiterated this concept that all power resided in the people, and the people reserved the exclusive right to alter and abolish their Constitution and form a new government whenever it was deemed advisable by the people. Thus, the control of the formal educational process was vested in all the people of Missouri by the Constitutions of the State of Missouri.
- (4) Early control of public education in Missouri was legally exercised by both the people at the annual school meeting and the elected boards of education. The township was chosen as the earliest organizational means for the management of public education in Missouri. Many people in Missouri were apathetic concerning the establishment of public schools, and they believed that formal education was a private matter. The earliest boards were created to protect the lands granted Missouri. There was abundant evidence to indicate that the General Assembly of Missouri intended to establish and finance the schools authorized in each township by the Constitution of 1820 through the income of the lands granted by Congress, rate bills, and fines, penalties and forfeitures.
- (5) The township organization dominated from 1820 to 1853, and from 1866 to 1875. The district system was adopted from 1853 to 1866 and from 1875 to 1956.
- (6) The annual school meeting permitted personal local control by qualified voters. Early school codes legally reserved major decisions for determination by the people at the annual meetings which included the election of board members by voice vote. With the movement of many people to the cities, the annual school meeting became cumbersome. Many of the duties legally reserved to the people were delegated subsequently by law to boards of education

or retained by the people and exercised through the impersonal representative ballot. The special election was the method adopted wherein the people determined bond issues, excessive tax levies, reorganization, and other decisions of major importance not delegated to the representative board of education.

(7) There has been a trend toward consolidation and greater centralization although the people of Missouri resisted consolidation principally because they feared the loss of local control. There has been a gradual decrease in the administrative control of public education as directly exercised by the people as more powers were vested in both the boards of education and school officials who were the representatives of the people in the implementation of local control of public education in Missouri.

394 pages. \$5.05. Mic 56-3309

#### EDUCATION, PHYSICAL

##### THE RELATIONSHIP OF SELECTED MEASURES OF ACTING BODY LEVERS TO BALL-THROWING VELOCITIES

(Publication No. 18,380)

Mary Elizabeth Bowne, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Professor Ruth B. Glassow and  
Professor C. W. Harris

The purpose of the study was to determine the relationship between selected measures of body levers contributing to throwing and the velocities achieved with balls in both the overhand and underhand throws using a softball and a baseball.

By the use of analysis of variance techniques it was possible to determine whether the lever variables discriminated between groups formed on the basis of throwing velocity scores and whether there was a pattern of lever contribution to the total velocity variance.

The lever variables selected for study included structure length measures and moment-arm measures of the selected acting body levers. Acting levers studied included those for trunk rotation, for medial rotation of the arm, for flexion of the arm and for flexion of the wrist.

Moment-arm and throwing velocity data were obtained from motion picture filming, tracing and measuring procedures. Structure length data were obtained by use of standard anthropometric measurement techniques.

Subjects for the study included forty-two high school girls chosen from the public high schools in Sioux City, Iowa, by a stratified random sampling procedure designed to permit the selection of subjects at three different levels of throwing velocity achievement.

Variance between the three velocity groups on the acting lever moment-arm measures and on the structure length measures was analyzed separately for each of the four throws. Moment-arm--velocity r and  $r^2$  coefficients were calculated to provide information as to (1) the extent to which variation in the moment-arm measure determined

variation in throwing velocity and (2) the percentage of velocity variance which could be accounted for in terms of variance of the moment-arms.

Results of analyses for the overhand throws showed that group differences were not significantly greater than observed individual differences for the moment-arm measures. A significant G x V interaction provided evidence that there was demonstrated with this data a pattern of lever contribution to throwing velocity. Study of the table of sums of moment-arm measures by groups indicated that at the moment of release of the ball a position of body segments which permitted the longest trunk lever moment-arm and the shortest arm lever moment-arm for medial rotation favored the achievement of better overhand throwing velocity with these subjects.

Analysis of structure length data for the overhand throws showed that there was not a pattern of structure length contribution to throwing velocity, and that the significant G x V interaction found in the moment-arm analysis was not a simple function of body structure lengths.

Correlation coefficients of both the trunk lever moment-arm and the arm lever moment-arm measures with softball and baseball overhand throwing velocities indicated that moment-arm measures had considerable predictive power relative to throwing velocity achieved by these subjects.

Study of  $r^2$  coefficients showed that substantial amounts of velocity variance (amounts ranging from eleven to twenty-four per cent) for the two overhand throws could be accounted for by variance of the trunk lever and of the arm lever moment-arm measures.

Results of the analyses with the underhand throws showed that neither moment-arm nor structure length measures discriminated between throwing velocity groups. Further, there was no evidence of any pattern of contribution of either set of measures to throwing velocity variance.

286 pages. \$3.70. Mic 56-3310

##### AN EVALUATION OF THE WOMEN'S NON-MAJOR PHYSICAL EDUCATION PROGRAM IN SELECTED AMERICAN COLLEGES AND UNIVERSITIES

(Publication No. 17,546)

Grace Elizabeth Buie, Ed.D.  
The University of Florida, 1956

##### Introductory Statement

This study was an attempt to discover the extent to which college physical education (non-major) programs were being adapted to meet the needs and demands of the changing role played by women in our present day society.

##### Statement of Problem

The three sub-problems of the study were: (1) to derive from a survey of statements concerning women's changing role, and the functions of physical education and education in our present day society, a set of criteria which could be used to evaluate existing programs of women's physical education; (2) to discover the status of certain aspects of women's programs of physical education in

the areas of philosophy and objectives, curriculum (activities), methods (operational procedure), and leadership; (3) to evaluate the present program in terms of statements of desirable functions as identified in the criteria.

#### Procedure

Sub-problem one, which was to develop a set of criteria, was formulated by extracting statements of authorities in physical education and education on what the function of education and physical education should be in the light of women's new role. These statements were categorized and a statement of generalization drawn for each category, arriving finally at seven criteria.

In sub-problem two a questionnaire was devised to determine the status of certain aspects of the women's program. Returns from 461 questionnaires, 60 per cent of the 766 accredited four year institutions invited to participate in the study, were used. Data were treated five different ways: as a total response of all institutions, and as a part of four categories: type of institution, size of institution, region or district in the United States, and by type of community.

In sub-problem three the findings of the status of women's programs today as determined by the devised questionnaire were evaluated in terms of the established set of criteria.

#### Findings

Although this study was the first comprehensive nationwide compilation of data concerning the status of the women's non-major physical education program in colleges, it is possible to make some comparison with other studies. Comparison revealed that requirement, awarding of credit, grading practices, value of coeducational activities, and the number of periods classes meet have all remained approximately the same for the last twenty years.

2. As yet, there has been very little acceptance and use of democratic procedures in women's physical education. The importance of democratic procedures was stated in the objectives but the practice was not widespread. It appeared that a minority of institutions in the field used teaching procedures that made possible the acquiring of skill by students in self-direction and cooperative group action.

3. The kind of emphasis being made in the women's program was not completely in line with the role women play in society today. To better meet the needs of women today, leisure time activities should be provided and the philosophy and practices which are outgrowths of the social objective (ability to work with others, and respect others), and the personal development objective (self-direction, self-appraisal, and self-control) should be given a major emphasis.

4. There was a grave discrepancy between the objectives stated and the marking procedures used in the women's non-major program. It was discovered that, although the social objective was judged most important, most marks awarded were based on attendance, skill, and knowledge. In the interest of increasing the effectiveness of the non-major program, it is suggested that further experimentation and study be made of the seemingly troublesome role of marking.

5. The strength of the women's non-major program ap-

peared to be the wide variety of activities. Fifty-eight activities were reported in the study.

321 pages. \$4.15. Mic 56-3311

#### A PROGRAM OF PROFESSIONAL TRAINING IN PHYSICAL EDUCATION FOR COLLEGES AND UNIVERSITIES IN JAPAN

(Publication No. 18,548)

Tetsuo Meshizuka, Ph.D.  
State University of Iowa, 1956

Chairman: Associate Professor Louis E. Alley

#### SUMMARY OF THE STUDY

The purpose of this study was to propose a program of professional training in physical education for colleges and universities in Japan. The proposed program of professional training in physical education was based upon a consideration of the following items:

1. A critical review of the present program of professional training in physical education in Japan in terms of (a) historical sketch of the development of professional training in physical education in Japan, (b) new professional institutions, (c) social status of physical-education teachers, (d) curriculum of professional training in physical education, and (e) certification requirements for teachers of physical education
2. A review of the factors which condition the nature of the program of professional training in physical education in Japan in terms of (a) geographical factors, (b) socio-economic factors, (c) biological factors, (d) pedagogical factors, and (e) duties undertaken by teachers of physical education
3. A comparative study based upon responses to questionnaires and upon inspection of university catalogues and course outlines in terms of (a) system of education, (b) requirements in physical education, (c) professional degrees, diplomas, and certificates, (d) professional curriculum, (e) staffs and comprehensive examinations, and (f) purposes of physical education

Guiding principles for establishing a program of professional training in physical education for colleges and universities in Japan were formulated.

A program of professional training in physical education was proposed in terms of (1) the undergraduate program of professional training in physical education and (2) the graduate program of professional training in physical education.

175 pages. \$2.30. Mic 56-3312

**PHILOSOPHICAL BASES FOR PHYSICAL EDUCATION EXPERIENCES CONSISTENT WITH THE GOALS OF GENERAL EDUCATION FOR COLLEGE WOMEN**

(Publication No. 17,675)

Betty Mary Spears, Ph.D.  
New York University, 1956

The purpose of this investigation is to make a practical contribution to the field of physical education for college women by establishing philosophical bases which provide for the realization of the goals of general education for college women through physical education experiences. This study is concerned with women students enrolled in undergraduate curricula in four-year institutions of higher learning located in the United States and is limited to public and private non-church controlled colleges and universities. The problem deals with the non-professional instructional program in physical education and the quality of the physical education experience in terms of the student.

Valid goals for general education for college women are selected through the process of extracting statements of existing goals from authoritative literature and synthesizing these statements into suitable aims. The derived goals are then submitted to a set of scientifically validated criteria for choosing aims for American democratic education. Goals selected and validated include developing the ability to attain self-realization, to function as a responsible citizen, to relate effectively to one's own and other societies, to approach all facets of life with critical and reflective thinking, to express ideas effectively and understand the ideas of others, to recognize the fundamental moral and ethical issues of society and formulate a critically held philosophy of life and to appreciate diversified aesthetic expressions and to participate in aesthetic experiences as a means of enriching one's own life.

On the bases of concepts of physical education which are shown to be compatible with the goals of general education for college women, principles for the conduct of physical education for college women are established. The principles developed comprise the framework within which student experiences in physical education are constructed. Five components of the student's experience are examined. These components are creating the inanimate environment, selecting the experiences, adapting the experiences, creating the animate environment and evaluating the experiences.

The inanimate climate of the physical education experience should be so created that the objectives of general education and physical education can be realized. The responsibility for selecting learning experiences carries with it the responsibility for knowing and understanding the needs and capacities of the individuals who are participating in the experiences. This investigation suggests a carefully planned orientation program designed to contribute to the goals of general education for college women. A desirable social climate fosters the self-realization of the student by developing democratic techniques through the use of the group process. The emotional and mental climate in each experience should be free from undesirable influences and encourage an atmosphere in which real contributions can be made for the effective integration of each person. The intellectual atmosphere is determined by the level of thought required in a situation. The process of evaluating the experiences in the physical education pro-

gram is directed toward determining if desirable growth, as stated by objectives, is being accomplished through the program activities and the situation provided. Evaluation in physical education experiences should involve the process of integrating the concepts and generalizations of the situation with the student's fund of meanings to be used in further experiencing. It is essential that both the teacher and student understand evaluation as a continuing function of an educational experience. The results of this investigation permit deeper insight into the implementation of the goals of general education for college women through physical education.

301 pages. \$3.90. Mic 56-3313

**EDUCATION, PSYCHOLOGY**

**A COMPARATIVE STUDY OF OVERACHIEVING AND UNDERACHIEVING COLLEGE STUDENTS ON FACTORS OTHER THAN SCHOLASTIC APTITUDE**

(Publication No. 17,301)

Ernest Marshall Boyce, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Alanson H. Edgerton

The purpose of this study was to determine if there are identifiable factors, other than scholastic achievement and aptitude, that are related to overachievement and underachievement in college.

Two groups, each consisting of forty-nine individuals, were compared on thirty-eight items pertaining to interests, personality characteristics, home and parental background, activity participation, health, reading skills, and vocational plans. Selection of the two groups was based on the assumption that the student with an average percentile rank for his class on the American Council on Education Psychological Examination (ACE), theoretically should earn the mean grade point average of his class for the first semester. These two values were equated by converting ACE percentile ranks and grade point averages to standard scores, which yielded an expected grade point average for each ACE percentile rank.

The one group, referred to as overachievers, was composed of forty-nine students who had achieved not less than .50 of a grade point average for their first semester above that predicted on the basis of the ACE. The other group, referred to as underachievers, was composed of forty-nine students who had achieved no better than .50 of a grade point average for their first semester below that predicted on the basis of the ACE. The spread of .50 of a grade point average, above or below the expected grade point average, was chosen arbitrarily as being sufficiently extreme for this study.

Only male Letters and Science students who had entered the University of Wisconsin as freshmen in the fall semesters of 1948 and 1949, and who had contacted the Student Counseling Center, were accepted for the sample. Those students carrying less than fourteen credits the first semester were not accepted.

The final criterion for accepting a student for the sample was that of completeness of data. It was essential that

the folder at the University of Wisconsin Student Counseling Center contain the following data:

- (1) Completed information blank.
- (2) Strong Vocational Interest Inventory.
- (3) Group form of the Minnesota Multiphasic Personality Inventory.
- (4) Cooperative English Test, Form T.

The chi-square statistic was used to test the proposed hypothesis as it is appropriate for testing whether a set of observed values differs significantly from those which would occur by chance alone. Percentages, means, and standard deviations were computed for those variables which lent themselves to that particular treatment, for the purpose of clarifying interpretation whenever pertinent.

Results of the study substantiate the hypothesis that there are significant differences between overachievers and underachievers in this population with respect to the thirty-eight non-intellectual variables investigated. Eleven of the variables were significant at the 5% level or less. These are the variables given primary consideration in the conclusions.

On the basis of these eleven variables, it may be concluded that a significantly greater number of overachievers than underachievers:

- (1) Have one or both parents foreign born.
- (2) Are non-residents of Wisconsin.
- (3) Live in a private residence at the University.
- (4) Feel that their study habits are efficient or average.
- (5) Feel that their reading skill is a handicap.
- (6) Have lived in larger cities most of their lives.
- (7) Devote more hours to study each week.
- (8) Have more deviate "depression" scores on the MMPI.

On the other hand, a significantly greater number of underachievers:

- (1) Have fathers engaged in professional and business occupations.
- (2) Have more deviate "hypomania" scores on the MMPI.
- (3) Have fathers with more formal education.

These conclusions pertain to the particular population investigated at the University of Wisconsin. Therefore, it is recommended that other studies be made to determine if these significant findings apply to all college populations.

117 pages. \$1.50. Mic 56-3314

#### A STUDY OF THE EFFECTIVENESS OF PERSONAL COUNSELING WITH SEVENTH GRADE PUPILS

(Publication No. 19,354)

Edward Fay McLaughlin, Ed.D.  
University of Houston, 1956

Statement of the problem. The purpose of the study was to determine the effectiveness of personal counseling in a public school environment by the use of measuring devices easily accessible to, and understood by, teachers.

Subjects. Matched pairs of seventh-grade pupils in Woodrow Wilson Junior High School, Port Arthur, Texas were used in an experimental-control group study. Members of the experimental group were selected by a random sampling technique from a seventh grade population of six

hundred eighty-six. Control group members were selected as matches on the basis of the following criteria: age, sex, Detroit Alpha Intelligence Test score, academic achievement on the Metropolitan Achievement Tests, Revised, Intermediate Partial Form S, and the section to which assigned in the seventh grade. The original number of matched pairs, seventy-three, was reduced to fifty during the school year as a result of removals from the school district and prolonged illness of some of the members.

Procedures. Throughout the school year personal counseling was provided for members of the experimental group, but no special program was provided for the rest of the school population. Boys in the experimental group were given the opportunity for as much counseling as they wished, and records of the number of sessions attended were kept. The general test of the effectiveness of the counseling provided was based on the (1) amount of gain reported for twelve criteria and (2) the number of experimental and control members reporting gains in the twelve criteria. The gain was the difference between the before-and-after counseling scores on the various criteria.

Criteria. Areas chosen for investigating the effectiveness of counseling were: achievement in school subjects, study habits and effort rating, personal adjustment, and social adjustment. Changes in these areas were estimated on the basis of the following criteria items: gains in grade-levels in arithmetic, language, and reading; report card ratings in achievement, effort rating, work habits, and citizenship; changing scores on the Mooney Problem Check List and the Mental Health Analysis; indication reports issued locally to show need for improvement in school work, referrals for disciplinary action, and peer status as evidenced by a locally designed sociometric device.

Summary of the findings. Differences in mean gains between the experimental and control groups appeared to favor the experimental group, but the differences were significant for only three criteria: effort rating, disciplinary referrals, and peer status. The difference of greatest significance was in peer status.

More individuals made gains in the experimental group than in the control group. However, the difference was below the ten percent level of confidence and cannot be considered significant.

The results suggested a positive relationship between frequency of counseling sessions and criteria gains.

There was no significant difference between the number of gains made by boys and girls.

138 pages. \$1.85. Mic 56-3315

#### THE SIGNIFICANCE OF QUANTITATIVE AND LINGUISTIC ABILITIES FOR ACADEMIC PERFORMANCE AND HIGH SCHOOL ADJUSTMENT

(Publication No. 18,590)

James Ray Pollard, Ed.D.  
University of Missouri, 1956

Supervisor: Paul C. Polmantier

PURPOSE: To describe the academic performance and high school adjustment of students who show discrepancies between linguistic and quantitative abilities as

measured on the American Council on Education Psychological Examination for High School Students, 1947 Edition.

**METHOD OF RESEARCH:** An analysis was made of three groups each of female and male high school students. Grouping was made on the basis of appreciable discrepancies between linguistic and quantitative abilities as measured by the A. C. E.: analysis of performance on tests of intelligence; analysis of performance on tests of achievement in language, reading, and mathematics; analysis of high school academic achievement; analysis of teacher ratings; and analysis of other school adjustment records.

**SUMMARY:**

- (1) The performances on tests of achievement in language and reading as well as tests of intelligence of girls classified as L-score Favorites were statistically superior to the performances of girls classified as Q-score Favorites.
- (2) The academic records and teacher ratings of social conduct and work habits in the classroom of girls classified as L-score Favorites were statistically higher than the academic records and teacher ratings of girls classified as Q-score Favorites.
- (3) Teacher ratings of mental, personal, and physical qualities, traits, and characteristics of girls classified as L-score Favorites were statistically higher than the ratings awarded girls classified as Q-score Favorites.
- (4) With few exceptions, the performances on tests of achievement in language and reading as well as tests of intelligence of girls classified as Q-score Favorites were statistically inferior to the performances of girls classified as No-score Favorites.
- (5) The academic records and teacher ratings of social conduct and work habits in the classroom of girls classified as Q-score Favorites were statistically lower than the academic records and teacher ratings of girls classified as No-score Favorites.
- (6) With few exceptions the performances on tests of achievement in language and reading of boys classified as L-score Favorites were statistically superior to the performances of boys classified as Q-score Favorites and to the performances of boys classified as No-score Favorites.
- (7) Other analyses made pertaining to the boys did not yield statistically significant differences among the groups.

**CONCLUSIONS:** In the light of the findings of this study, and insofar as they might apply to students in other high schools, the following conclusions seem to be warranted:

- (1) On a particular grade level in high school discrepancy scores for girls on the A. C. E. are more indicative of differentiated academic performance and adjustment status than are discrepancy scores for boys.
- (2) Discrepancy scores indicate that girls whose performances on the Linguistic factor are higher than

their performances on the Quantitative factor will have significantly better achievement and adjustment in high school than girls whose performances on the Quantitative factor are higher than their performances on the Linguistic factor.

- (3) Girls whose performances on the Quantitative factor are higher than their performances on the Linguistic factor will be significantly poorer in academic achievement and adjustment, with few exceptions, than those girls who are not discrepant on the two factors.
- (4) Discrepancy scores indicate that while generally boys whose performances on the Linguistic factor are higher than their performances on the Quantitative factor will do better on reading and language than boys without discrepancy scores, or than those boys whose Quantitative scores are higher than their Linguistic scores, their academic achievement and adjustment in high school will not be differentiated significantly from those of the other two groups of boys.

236 pages. \$3.05. Mic 56-3316

**DRAWING AND LEARNING IN BIOLOGY: THE RELATIONSHIP BETWEEN PUPILS' DRAWINGS OF VISUAL AIDS AND THEIR LEARNING IN BIOLOGY**

(Publication No. 17,078)

Marion Richter, Ph.D.  
Columbia University, 1956

The object of the present investigation was to examine the possibility of a relationship between the way in which pupils draw the objective materials used in biology classes and their learning of biological subject matter. To get the needed information a large number of drawings of biological subjects in chart form were secured. At the same time, scores on both verbal and nonverbal intelligence tests, as well as scores on subject matter tests were also obtained. The drawings were then rated by judges for the "goodness" or accuracy with which the object was drawn. From these ratings, which were highly reliable, an average accuracy score was obtained for each pupil.

The writer then rated the drawings for the presence or absence of specific characteristics sometimes considered by psychologists to be indications of certain aspects of personality. These ratings also included characteristics of drawings considered important by biology teachers.

The ratings for the individual characteristics of drawings were then correlated with the average drawing scores and, in addition, with scores on subject matter tests, with intelligence test scores, with scores obtained on a Gestalt completion test, and with final marks. The consistency with which each characteristic was used by each pupil was determined by correlating its appearance on one drawing with its appearance on every other drawing by each pupil.

Finally, an attempt was made to find meaning in the mass of correlation coefficients resulting from the above-described methods. This search for meanings included determining the reliability of the drawing characteristics and treating the correlation coefficients by grouping them in various ways. Suggested interpretations of the data

according to both the factual findings and the psychological factors shown to be present in the data are included in this report.

As a result of these methods of securing and analyzing the data the following conclusions were drawn.

1. The first hypothesis that the goodness or accuracy with which the charts are drawn does have some relationship to both the amount and quality of learning of the biological subject matter, does find support in the data secured by the described methods. Both the average drawing scores for the drawings as a whole, and the ratings for a few of the individual characteristics of the drawings do show some correlations with learning and with intelligence. These correlations are all statistically significant. Although they are not very high, the fact that they exist at all makes them unusual. Both drawing and learning seem to be functions of intelligence and are not causally related to each other.

2. The second hypothesis that the specific structural characteristics of the drawings may give added information about possible personality components if they appear consistently in the consecutive drawings of an individual, does find a limited amount of support in the data secured. Relatively few characteristics are consistent and reliable in their appearance on these drawings. A few characteristics are reliably correlated with the measures of learning, of drawing accuracy, and of intelligence.

3. The level of reliability seems to be affected by either the drawing motif itself, or by something in the external drawing situation, or by emotional factors in the pupils as they draw.

4. Variability, as shown by the individual pupil variances for some of the characteristics, seems to be more highly correlated with good performance than does consistency, at least for a few characteristics.

5. A few of the psychological characteristics are significantly correlated with learning, even though there is no logical reason to expect such correlation. If the psychological interpretations often assigned to these characteristics are correct, then these correlations may indicate that aspects of personality are correlated with learning of specific subject matter.

6. The findings suggest that visual, nonverbal aspects of intelligence may be important in learning from visual aids of all kinds. Biology teachers need to investigate this possibility, since they use objective visual aids constantly in their classes.

7. There is some indication in the data that the characteristics that predispose toward success on pre-tests differs from those that function in post-tests. This also needs further study.

118 pages. \$1.50. Mic 56-3317

**THE REHABILITATION OF POTENTIALLY EMPLOYABLE HOMEBOUND ADULTS:  
A RESEARCH PROJECT UNDERTAKEN JOINTLY  
WITH THE NEW YORK STATE DIVISION OF  
VOCATIONAL REHABILITATION AND THE NEW  
YORK UNIVERSITY-BELLEVUE HOSPITAL  
REHABILITATION SERVICE**

(Publication No. 17,676)

Leo Len Stein, Ph.D.  
New York University, 1956

In conjunction with the New York State Division of Vocational Rehabilitation, a rehabilitation team from the New York University - Bellevue Medical Center tested the hypothesis that through a program of evaluation and treatment it could assist a significant proportion of potentially employable homebound adults to improved functioning ability thereby enabling some to overcome their homebound status.

The study population consisted of a group of twenty-five individuals in series who had applied to the State agency for vocational rehabilitation services, and who were found to be eligible and feasible for homebound employment. Selection of the cases was solely by that agency utilizing the same criteria previously employed. To establish eligibility, the applicant's doctor had to certify in detail that the client was homebound and would so remain, but was capable of working at least a six-hour day, five-day week. Feasibility was determined by the State agency after considering all facts from a vocational standpoint. This group was then compared by the rehabilitation team with itself before and after it went through the evaluation-rehabilitation process. It was likewise compared with a similarly selected, equal number of the immediately preceding accepted clients for homebound employment who did not go through the process provided by the rehabilitation team.

To arrive at valid before and after measurements of the groups, the team members used and devised various measurements and numerous items of comparison which enabled them to determine the characteristics, goals, needs, and progress of both groups. A detailed analysis of both groups revealed that they were quite similar at their times of initial evaluation, except that the rehabilitation group was older (with a mean age of forty-five years) by seven and a half years at the .05 level of confidence. There was no initial difference in their abilities in the Activities of Daily Living. From a medical standpoint, the Degree of Severity of Disability, and the Cause of Disability were almost the same for both groups.

At follow-up evaluation, the previous group showed no significant improvement in any of the A.D.L. classifications, and none were employed outside of the home. On the other hand, the rehabilitation group improved significantly at the .01 level with reference to ability to Elevate, to Leave the Home, and to Go Out to Work. Six in this group were employed outside of the home, and three were in training for outside employment.

None in either group had been employed when accepted by the State agency for vocational rehabilitation services. At follow-up, eighteen (three on a part-time basis) of the preceding group were earning at the rate of \$17,992 a year. Even though at the time of follow-up, only fifteen were thus far employed in the rehabilitation group, they were earning at the rate of \$21,892 a year - better

statistically at the .05 level. The higher level was due to the higher income of the non-homebound workers.

Recommendations made to provide or improve services to the potentially employable homebound adult, included the following:

1. That the study be continued to further clarify and establish methods and techniques for the use of other states and communities on how to best service the homebound, among other ways through the coordination of available community resources.
2. That other experimentation-demonstration projects be undertaken in other parts of the country to meet the demands of local situations.
3. That all possible referral sources, including the homebound themselves, be made aware of the help potentially available through rehabilitation services.

221 pages. \$2.90. Mic 56-3318

#### AN ANALYSIS OF THE PROFESSIONAL GUIDANCE POSITION OF CERTIFIED SECONDARY SCHOOL COUNSELORS IN MISSOURI

(Publication No. 18,595)

Willard Wesley Tennyson, Ed.D.  
University of Missouri, 1956

Supervisors: Paul C. Polmantier and John L. Ferguson

**PURPOSE:** To study the responsibilities and functions of selected, certified counselors in Missouri public secondary schools and to determine those responsibilities and functions which counselors believed their position should entail.

**PROCEDURE:** Two methods were used to obtain information. First, an information form was directed to 160 counselors selected with certain criteria in mind. A total of 152 of these persons responded to this inquiry, representing a 95 per cent return. Second, 29 counselors were interviewed for the purpose of determining the authenticity of the counselors' responses to the information form.

#### SUMMARY:

- (1) Great variability existed in the time spent by counselors on guidance activities and their perceptions concerning how their time should be distributed. In general, however, there was somewhat closer agreement concerning how time should be spent.
- (2) Although teachers were using his services, the faculty received less time from the counselor than has generally been advocated by authorities in the guidance field.
- (3) Over a third of the guidance workers' counseling time was spent in academic advising, with almost half of the counselors indicating that they were completely responsible for this program. This advising was considered an important and logical part of their job.
- (4) The counselors felt that less time should be spent in occupational and educational information, but they believed they should be doing more group work in this area.

- (5) Job placement and follow-up were functions which for the most part received only incidental attention from the counselors, although they felt they should give more time to follow-up and assume more responsibility for evaluation of the guidance program.
- (6) It appeared that guidance workers would assume more responsibility for in-service training of teachers.
- (7) No significant differences between Professional, Teacher-Counselor, and Temporary certificated counselors were found in the mean percentages of time spent on guidance services and functions, nor were differences of this kind found in the counselors' perceptions of how their time should be distributed.

#### CONCLUSIONS:

- (1) The counselors were not fully satisfied with the job as it was carried out in practice, but felt that a number of important changes should be made in the kinds of guidance functions performed and the manner in which time was allocated to these functions.
- (2) The counselors lacked the time necessary for performing the job as they would like. Academic advising functions performed by most of the counselors and the heavy teaching assignments held by some of these persons were two factors which seemed to be contributing to this problem.
- (3) The job as performed and perceived by the counselors was problem oriented. In addition to working with children who have problems, these persons envisioned a program in which the counselor would give greater assistance to teachers who, in turn, would assume a somewhat more active role in the handling of these problems.
- (4) The counselors were of the opinion that the guidance committee should be given considerably more responsibility for coordinating the guidance program and planning guidance activities.
- (5) No conclusive evidence was found that the kinds of functions performed by the counselors varied with the level of training and experience of those counselors. The quality of the work performed by these professional persons was not investigated in the present study.
- (6) Great variability existed in both the time spent by counselors on guidance activities and their perceptions concerning how that time should be distributed, although such variability appeared to be more characteristic of those persons with the least professional training and experience.

387 pages. \$4.95. Mic 56-3319

**EDUCATION, TEACHER TRAINING****OPINIONS OF HIGH SCHOOL BIOLOGY TEACHERS CONCERNING THE FIFTH YEAR OF TRAINING FOR BIOLOGY TEACHERS**

(Publication No. 19,266)

William Ermal Boyd, Ed.D.  
Indiana University, 1956

Chairman: Philip Peak

The purposes of this investigation were: (1) to survey the opinions of secondary biology teachers by means of a questionnaire devised especially for this purpose, and (2) to interpret the findings of this survey in relation to the need for desirable changes in the fifth year of training for secondary biology teachers. The major aspects of this problem were: (1) what are the opinions of biology teachers concerning present programs in biology and education, (2) what suggestions for improvement can teachers offer, and (3) what factors influence the attitudes of teachers concerning graduate programs?

A questionnaire, devised with the help of biology teachers and professional education teachers, was sent to a random sample of 500 secondary biology teachers in six eastern and mid-western states representing three accrediting associations. Teachers cooperating in the study were asked to indicate their agreement or disagreement with 18 statements concerning the fifth year program and to rank 28 courses, arranged in four groups, according to their estimated value in the fifth year program. Data from the 313 returns were tabulated and examined to determine opinions about the statements and course rankings; and to determine the dependence of opinions upon length of teaching experience, amount of graduate and undergraduate biology taken, and experience with the course being ranked.

The major conclusions of this study include: (1) Biology courses, including laboratory, should constitute at least fifty percent of the fifth year program. (2) Approximately fifteen percent of the fifth year program should be devoted to each of the areas: research, professional education courses, and observation and practice teaching. (3) Advanced methods courses should be offered and conducted either by the biology departments or cooperatively by the education department and the biology departments. (4) Laboratory facilities should be provided so that teachers may have experience working with audio-visual, curriculum, and laboratory materials related to biology. (5) Students should be encouraged to have one year of full-time teaching experience before beginning the fifth year program. (6) Introductory courses in related sciences, offering graduate credit without prerequisites and prepared especially for secondary teachers, should be provided in the fifth year.

On the basis of the foregoing conclusions, the following recommendations were made: The fifth year program for biology teachers should place greater emphasis upon biology courses and courses related to biology teaching. Introductory courses in related sciences should be designed for secondary teachers and offered for graduate credit without prerequisites. Laboratory facilities and teaching methods should be so designed and selected as to provide the student with wider experience with audio-visual, curriculum, and laboratory materials and preparation.

96 pages. \$1.50. Mic 56-3320

**AN APPRAISAL BY PROFESSIONAL NON-SCHOOL PERSONNEL OF TEACHER PERFORMANCE IN CONDUCTING PROGRAMS OF VOCATIONAL AGRICULTURE**

(Publication No. 18,783)

Lowery Heywood Davis, Ph.D.  
The Ohio State University, 1956

The purpose of the study was to secure an appraisal of teacher performance which could be used in improving the teacher education curriculum. The study was one in a series conducted by the Department of Agricultural Education at the Ohio State University. The appraisal was made by county agricultural extension agents, soil conservationists, deputy Grange masters, and Farm Bureau organization directors. An 86 per cent response was received from 284 persons located in 76 counties in Ohio where vocational agriculture was offered in the secondary schools.

Tentative criteria by which teacher performance was evaluated were identified by interview of typical personnel from the respective organizations and agencies. These criteria were submitted to all representatives of the selected groups for appraisal of the importance of each criterion as an aspect of a successful program of vocational agriculture as well as for an appraisal of the performance of teachers. The evaluators were also asked to appraise teacher preparation in areas of technical agriculture.

Of the 38 criteria identified, 36 were regarded as of "considerable importance" and two of "some importance" on a scale including "no," "little," "some," "considerable," and "great." In the analysis of the data, the criteria were classified into five areas. These were, in order of decreasing importance: instruction; supervised farming; possession of personal traits and characteristics; relationships with related agencies, organizations, and individuals; and general school and community relationships. No additional criteria or modifications in those presented were suggested by the 245 evaluators.

Teachers exhibited most proficiency in the areas of supervised farming, possession of personal traits and characteristics, and instruction. Less proficiency was evident in the area of general school and community relationships, and least proficiency was evident in relationships with related agencies, organizations, and individuals.

Evaluators believed that most teacher preparation was evident in the areas of dairy and livestock production, agronomy, and agricultural engineering. Less preparation was evident in poultry and agricultural economics, and the least preparation was evident in horticulture and forestry.

It was believed that need for curricular improvement should be expressed by a term reflecting both the importance of criteria and the level of teacher performance. Consequently, the need for improvement in teacher preparation was expressed in terms of an index derived arithmetically by weighting deficiency in teacher performance with the rated importance of a given criterion.

Considerable need for curricular improvement was revealed in teacher relationships with allied agencies, organizations, and individuals. Specifically, teachers were most deficient in program planning. Criteria relating to program planning concerned the use of lay committees, coordination of vocational agricultural activities, and working with allied agencies and organizations in making long-time plans. Some need for improvement was evident in the area of general school and community relationships.

Within this area, need for improvement was most evident in the broad aspects of public relations, particularly in the effective use of radio, television, and newspapers. Teachers seemed best prepared in the areas of supervised farming, instruction, and in the possession of traits and characteristics desirable in teaching.

According to the evaluations additional emphasis in areas of teacher preparation should be given in the following order: (1) relationships with related agencies, organizations, and individuals, (2) general school and community relationships, (3) instructional program, (4) personal traits and characteristics, and (5) supervised farming.

210 pages. \$2.75. Mic 56-3321

**AN EVALUATION OF THE IN-SERVICE PROGRAM PROVIDED BY THE UNIVERSITY OF NEBRASKA FOR TEACHERS OF VOCATIONAL AGRICULTURE**

(Publication No. 18,574)

Howard Winnett Deems, Ed.D.  
University of Missouri, 1956

Supervisor: G. F. Ekstrom

The major purpose of this study was to determine the strengths and the weaknesses of the in-service program provided by the University of Nebraska for teachers of vocational agriculture in the state. More specifically, the study sought to gather information concerning:

1. The basic principles of in-service education as revealed by leading educators in their writings.
2. Some guiding principles of in-service education for institutions training teachers of vocational agriculture.
3. The in-service needs of teachers of vocational agriculture as revealed by the opinions of teachers.
4. The extent to which teachers of vocational agriculture use the in-service program sponsored and made available by the University of Nebraska.
5. The phases of the present in-service program that have been of the greatest value to the teachers.

Data for the study were secured: (1) from a group of specialists as a jury, (2) through an information form sent to the teachers of vocational agriculture, (3) through interviews with teachers and specialists, (4) from school and personnel records as found in the Department of Education and the Department of Vocational Education, University of Nebraska, and (5) from an examination of pertinent literature in the field.

**Summary**

The 132 respondents evaluated the four main phases of the in-service program in the following order: (1) workshops, (2) informational services, (3) consultative services, and (4) graduate courses.

In agricultural subject matter, need for training evolved around new developments in farming. The farm skills in which respondents indicated the greatest need for training were in farm mechanics. In professional courses the need

for training was in the use of advisory councils, and the guidance of students.

**Conclusions**

1. The teacher-training institution should make in-service education a definite part of the total education program.

Definite plans and policies for the program should be formulated cooperatively and democratically by all concerned with, and affected by, such plans and policies. Adequate finances, suitable facilities, and necessary professional personnel should be provided.

2. The teacher-training institution should provide a complete program of services to meet the needs of teachers for professional growth.

The program should contain professional and technical courses provided both on and off-campus at times convenient to teachers. Non-credit workshops for the development of skills and abilities should be conducted as needed. Informational services of proper scope and variety to keep teachers informed should be provided. Consultative services, in the form of visits to teachers and on-campus conferences, should be maintained for all teachers, but especially planned for beginning teachers. A research program should be conducted in cooperation with the state department of education.

3. Teachers of vocational agriculture need training in many areas of instruction, but the needs are greater in some areas than in others.

Teachers of vocational agriculture have the greatest need for training in: (1) new developments in agriculture, (2) the development of abilities to perform certain skills in farm mechanics, (3) training in organizing and using advisory councils, (4) training in organizing and conducting young farmer and adult classes, (5) instruction in student guidance and educational psychology, (6) instruction in miscellaneous problems such as budgeting time and keeping up to date on new ideas, and (7) training in the use of proper techniques of publicity.

4. Teachers of vocational agriculture tend to take courses that are available and convenient to take, and those that are needed to meet requirements for certification or advanced degrees.

5. The teacher-training institution does not necessarily provide course offerings and other in-service activities in the areas of greatest need of the teachers.

6. The teacher-training institution should develop a more extensive program of teacher workshops.

278 pages. \$3.60. Mic 56-3322

**GENERAL RELATED INSTRUCTION NEEDED BY STUDENTS IN COOPERATIVE OCCUPATIONAL TRAINING**

(Publication No. 17,902)

Evan Max Eddy, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. H. H. London

**PURPOSE OF STUDY:** The purpose of this study was to ascertain the general related instruction currently provided students in cooperative occupational training, the

importance of instruction in terms of the needs of co-operative trainees, and additional instruction needed which is not currently provided.

**METHOD OF RESEARCH:** General related instructional materials from ten states were assembled and analyzed for instruction topics. Related topics were grouped together forming major areas of instruction and placed in an information form. The form was sent to respondents representing eight populations--local employers, former trainees, Missouri coordinators, local labor leaders, personnel directors, regional labor leaders, superior coordinators from twelve states, and teacher educators and state supervisors. Respondents evaluated each topic as to its importance ("great," "moderate," or "no") in terms of the needs of young workers and wrote in topics which, in their opinion, should be added to the instruction.

Data were tabulated and a weighted mean technique used to arrive at a composite measure of the relative importance of each topic. Topics were listed in order of their rank.

**SUMMARY AND CONCLUSIONS:** One-hundred and sixty-eight instruction topics were identified which were common to several states.

The composite evaluation showed that the importance of topics ranged between "moderate" and "great," indicating that a variety of instruction is needed by young workers.

Generally, topics in the areas concerned with choosing and preparing for a job, getting and adjusting to the job, personality and personal progress, and employer-employee relations were considered of most importance.

Less importance was attached to instruction topics concerning labor laws, problems of management and business ownership, and labor unions.

Local coordinators, local labor leaders, and former trainees consider current instruction of most importance to young workers. Regional labor leaders, personnel directors, and teacher educators and state supervisors were more critical of the related instruction currently offered.

Eleven topics were suggested as needed additional instruction by respondents representing a majority of groups. A majority of these topics indicated a need for expanding instruction in employer-employee relations.

Concern was expressed by many respondents about duplication of instruction of general education courses in related study classes.

Because of the nature of general related instruction and its importance, coordinators should be provided professional training which will aid them in this function. Professional training in guidance and counseling is also needed by coordinators.

Group instruction techniques may well be used in providing general related instruction to students in classes representing a diversity of occupations.

Greatest emphasis should be placed upon areas of instruction which are of greatest importance to trainees.

**RECOMMENDATIONS:** Research should be continually provided to serve as a basis of keeping general related instruction in line with the needs of trainees.

Coordinators and counselors should work together

to better serve trainees. Coordinators should have training in guidance and counseling techniques.

The professional training of coordinators should acquaint him with the informational content of general related instruction.

Instruction in the area of employer-employee relations should be somewhat broadened and additional emphasis should be placed upon instruction in this area.

182 pages. \$2.40. Mic 56-3323

#### THE ROLE OF INSTRUCTIONAL AIDS IN ARITHMETIC EDUCATION

(Publication No. 18,788)

William Patton Eidson, Ph.D.  
The Ohio State University, 1956

**Purpose.** The major purpose of the study was to define the role of instructional aids in the elementary-school arithmetic program. Subsidiary purposes were: (a) development of criteria for selecting and using arithmetic instructional aids, (b) construction of a satisfactorily valid objective instrument for ascertaining, in part, prospective-teacher understanding of the selection and use of arithmetic instructional aids, and (c) development of a check list for ascertaining, in part, prospective-teacher understanding of the use of arithmetic instructional aids on a performance basis.

**Method.** The role of instructional aids in arithmetic education was determined by making a comprehensive analysis of pertinent literature. Criteria for the selection and use of arithmetic instructional aids were developed by applying commonly accepted principles of education to the use of such materials.

The method used in constructing the objective-testing instrument was: (a) constructing raw 5-option multiple-choice items related to the use of instructional aids for attaining the objectives of the elementary-school arithmetic program; (b) revising and refining items, following their critical analysis by graduate students and staff consultants; (c) building two 60-item test forms of the best items for use in initial tryouts on prospective elementary-school teachers; (d) selecting the 60 most effective items for the final form; (e) administration of the improved test to another population of prospective elementary-school teachers to ascertain its reliability coefficient, this procedure being accomplished by the split-halves (odds-evens) method and application of the Cronbach formula; (f) correlation of the test with four external criteria by use of the Pearson formula for grouped scores; (g) administration of the test to a small sampling of experienced elementary-school teachers to determine its suitability in evaluating their understanding of arithmetic aids.

The check list was constructed by applying the criteria developed from established principles of education to the attainment of 23 basic concepts of arithmetic.

**Conclusions:** (a) proper utilization of arithmetic instructional aids is based upon the same framework of principles on which all good teaching procedures operate; (b) the most effective results are obtained by placing the major emphasis on arithmetic instructional aids as sources of data rather than as supplementary devices;

(c) instructional aids themselves seldom teach arithmetic; the role of the teacher in their use is paramount; (d) the objective instrument developed by the writer is satisfactorily valid for the purpose intended; (e) on the basis of a limited sampling, the objective instrument is also valid when applied to experienced teachers; (f) the check list would appear to be valid, since it is devised from commonly accepted principles of learning and objectives of the elementary-school arithmetic program.

**Recommendations:** (a) in arithmetic-education courses, full use should be made of instructional aids; (b) colleges of education should coöperate with arithmetic-education instructors to build up adequate supplies of instructional aids to be housed in classrooms where arithmetic-education courses are taught; (c) teacher-education staffs in elementary education should make reasonably certain that pre-service teachers possess an adequate understanding of the use of arithmetic instructional aids; (d) coöoperating teachers should encourage student-teachers to spend time, proportionate to its importance, in arithmetic instruction, thereby affording them opportunities to make use of instructional aids; (e) in-service teachers who are inadequately prepared in the selection and use of arithmetic instructional aids should be helped to acquire competence in such techniques through graduate courses, workshops, and other means.

356 pages. \$4.55. Mic 56-3324

data from the cooperating schools. Questionnaires were also sent to the teachers of the methods and observation and participation courses to obtain their opinions of the strengths and weaknesses of the program. The data were summarized and tables made for further study.

**Conclusions.** The instruments used for gathering the data in this study were not standardized. The questionnaire responses were of the opinionnaire type. Recognizing these limitations the following conclusions were made:

1. A plan should be formulated whereby more teachers and administrators would become aware of the procedures, techniques, methods, values and ways of evaluation that should be used relative to the September School Experience Program in training prospective teachers.

2. The value of the participation to the students and to the cooperating schools may be lessened by the participants' freedom to select the beginning date and the length of the experience.

3. There is little screening by the School of Education of the schools, supervising teachers or kinds of experience provided the students. The students feel the lack of this kind of selection or screening by the School of Education.

4. The existing report and evaluation forms are inadequate and ineffectual and need to be revised.

5. The orientation or readiness of the students for the September school experience is inadequate.

6. The participating students believe that great values are derived from the September experience. Opportunities for first-hand experiences with children, teachers, and schools are provided the students, in many cases for the first time.

7. The students form many ideas, convictions and conclusions from the different techniques and methods which they observe. Some of these are good, some are not. They should not be ignored, rather they should be shared and discussed under the guidance of an experienced teacher in the professional semester courses.

8. If the September School Experience Program is to function at its best there should be a central office in the School of Education with a coordinator in charge of the program.

9. The cooperating schools' report forms contain valuable but seldom used information about the September participants and the schools they select for their participation. These reports could serve as valuable counseling devices.

10. If optimal values are to be gained by the students from the September School Experience Program the program must become an integral part of the entire program for the School of Education.

239 pages. \$3.10. Mic 56-3325

#### A STUDY OF THE STRUCTURE AND INTERACTION OF A GROUP OF TURKISH STUDENTS AT THE UNIVERSITY OF FLORIDA, OCTOBER, 1952 TO JUNE, 1953

(Publication No. 17,551)

Eleanor Kuhlman Green, Ed.D.  
The University of Florida, 1956

The problem for this study was: (1) to analyze interpersonal interaction among a group of selected Turkish

students studying at the University of Florida from October, 1952, to June, 1953, in a rural education project and (2) to identify variables which seem to affect group cohesiveness.

The purpose of the study was to gain insight into the functioning of a foreign group working under the following experimental conditions: (1) the group was sent abroad as a team to study problems of rural education and teacher education; (2) personnel held varying degrees of educational status and social prestige; (3) the group was non-English-speaking upon its arrival; (4) experimental ways for working with the group became necessary.

Procedures included reviews of the literature in the fields of cross-cultural education, of modern Turkish history, of culture and personality development, and of group dynamics. Data were obtained from these sources:

1. Correspondence and records in the files of the Turkish Project.
2. Records of individual and group behavior in seminars at the University of Florida, during field experiences, and in pursuits of individual interests.
3. Sociometric results and records of interpersonal choices in social and working groups.
4. Interviews with the twenty-five Turks and selected persons with whom the Turks had contacts.
5. Anecdotal data for each of the six phases through which the Project progressed.
6. Participation of individuals in group discussions.

Interpersonal interaction was analyzed in relation to the communication structure, the power and friendship structure of the group, and movement toward goals. Factors influencing cohesiveness and changes in group structure and functioning were identified.

The hypotheses underlying the study were as follows:

1. When a group of foreign students having no formally established relationships are brought together to interact in group activities with common goals, a group structure with hierachal positions or roles can be readily identified.
2. Structure of this group will change in the direction of cooperative interaction as such experiences as planning, arriving at group decisions, and assuming group responsibilities are provided in new physical and social settings.
3. A group of foreign nationals with no English-speaking skills in a workshop situation in an American university will move through identifiable phases of adjustment during the term of study.
4. Data about this group will reveal a pattern of interaction which will make it possible to identify some of the major factors and variables which seem to affect the adjustment of the group.
5. Democratic processes used in the workshop will be accepted by the Turkish students as consistent with their own goals and those expressed by the Ministry of Education.

Hypotheses 1, 2, 3, and 4 were supported by the findings of this study. Hypothesis 5 was not fully supported. Cultural forces related to status and prestige inhibited full acceptance of democratic processes within time limits of the Project.

Variables affecting cohesiveness of the group were identified as: (1) the translation process; (2) individual interests; (3) status and prestige factors; (4) the central task assigned to the group; (5) cultural customs and practices; and (6) personal anxieties and concerns.

A premise underlying the development of the Project was that Americans working with the Turks could help them to select from the American frame of reference behavior patterns which would be desirable and could be adapted to the Turkish setting. An implication of this study is that

expectancies for change or even adaptation defined within one cultural context should be carefully examined by persons who are working with groups of a different culture. When those groups are in early developmental stages of democratic living, change or adaptation in accordance with American standards may be impractical or impossible.

664 pages. \$8.40. Mic 56-3326

#### A STUDY OF THE EDUCATIONAL PREPARATION OF JUNIOR HIGH SCHOOL TEACHERS AS VIEWED FROM THEIR OPINIONS

(Publication No. 18,718)

Homer O. Harvey, Ed.D.  
Bradley University, 1956

Assuming that the junior high school has become a permanent institution in the public school system of the United States, we must strive in whatever ways feasible to render it as effective as we know how. During its years of growth, the junior high school has suffered from many ills, some of which still persist. Not the least of these is lack of adequately-trained teachers. The dearth of teacher preparation schools offering an established educational program for prospective junior high school teachers makes it difficult for trainees to fit themselves for this kind of teaching.

This study attempts to determine the level of preparation most suitable for junior high school teachers as based on the opinions of a thousand junior high school teachers representing all geographic areas of the United States. Specific courses in education and allied fields are evaluated in the light of the opinions held by those teaching in the various subject matter fields common to the junior high school. Special consideration is given to clock hours spent in charge of the class during student teaching. What should be its ideal duration? How best can it be improved? Of interest to the study are the opinions of those participating as to the relative importance of study of the techniques of teaching and of study in subject matter areas.

The study points out possible weaknesses in preparation of junior high school teachers. It is hoped that this might aid teachers colleges in preparing beginning teachers for their work as thoroughly as their predecessors would like to have been prepared. 90 pages. \$1.50. Mic 56-3327

#### PUPIL EXPECTATIONS OF STUDENT TEACHER BEHAVIOR IN CERTAIN SELECTED CLASSROOM SITUATIONS

(Publication No. 19,110)

Elizabeth Vass Lewis, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Virgil E. Herrick

The purpose of this descriptive study was to find out how well pupils understand the behavior of their student teachers in certain selected classroom situations. The

specific question to be answered was: to what extent is there agreement shown within the stated expectations of the student teacher, supervisor and pupils related to student teacher behavior in certain selected problem situations in the classroom.

Twenty-one student teachers in the student teaching program of a liberal arts college, their twenty-one supervising teachers (called supervisors in this study), who taught in the public and parochial schools of a southern city and the pupils in twenty-nine secondary school classrooms participated in the study.

These individuals were asked to respond to a devised instrument composed of descriptive paragraphs based on the most frequently-mentioned secondary school classroom problems of the twenty-one student teachers. The respondents were to state what they thought their student teachers would do in the problem situations. Their responses, constituting the data for this study were collected by the college coordinator, who administered the instrument during a visit to each classroom after the student teachers had completed their teaching assignments. The student teachers' responses were collected at one of the weekly meetings of the student teaching group.

Student teachers responded also to the Minnesota Teacher Attitude Inventory, a measure of teachers' attitudes from which interpersonal relationships with pupils may be predicted. This Inventory was used for validating the devised instrument. Student teachers' scores on the two instruments correlated .69.

The data were categorized according to dominative, neutral and integrative behavior. Indices of response were calculated and compared for individuals and groups. The degree of agreement was determined between pupils', student teachers' and supervisors' stated expectations of how the student teacher would behave in the ten teaching situations.

The student teachers, in general, indicated they expected to evidence integrative behavior in the problem situations. Supervisors varied in what they expected their student teachers to do in the problem situations. On the basis of total scores, however, they supported the student teachers in stating they expected student teachers to evidence integrative behavior. The pupils in classes indicated that they expected dominative behavior from their student teachers.

Correlation coefficients were: .35 between student teachers and supervisors; .26 between student teachers and pupils; .00 between supervisors and pupils.

Among sub-groups: senior high school pupils, girls, academic classes and pupils in classes taught for twelve weeks, had indices which agreed more closely with their student teachers' indices than any other groups.

According to the results of this study, secondary school pupils do not appear to agree with student teachers' stated expectations as to how they (the student teachers) would behave in the selected classroom situations, nor do they agree with the supervisors' stated expectations. This difference in stated expectations may be due more to stereotypes of teacher behavior in the pupils' stated expectancies than in their lack of predictability.

Differences in level, sex, subject and time taught, tended to make some difference in the agreement between pupils and student teachers in their stated expectations of student teacher performance in the selected classroom situations.

This study has significance for the area of teacher-pupil relationships and reveals the need for a more effective consensus between pupils and teachers as to the behavioral objectives in the classroom.

185 pages. \$2.45. Mic 56-3328

#### STUDIES IN ECONOMIC EDUCATION IN IOWA, PART I: THE TEACHER IN THE SECONDARY SCHOOL

(Publication No. 18,550)

Elwyn R. Miller, Ph.D.  
State University of Iowa, 1956

Co-chairmen: Professor John H. Haefner and  
Associate Professor Clark C. Bloom

The purpose of this study was to obtain an accurate and intensive description of the professional backgrounds of all teachers of major economic content in the public secondary schools of six selected Iowa counties. Primarily social studies teachers were involved. In this study answers were attempted to four questions about these teachers: (1) What were their personal backgrounds, their training, and their professional experiences? (2) To what extent did they grasp knowledge of educational theory, techniques, and methods as professional educators? (3) To what economic attitudes did they adhere? and (4) What were the strengths and weaknesses in their grasp of economic content and theory? Traditional courses assumed to have major economic content were: economics, American history, world history, modern problems, civics or government, and sociology. The six county sample was stratified according to per capita income, ranging from the poorest to the wealthiest county categories, which gave a rough measure of the ability of each area to support public education. Methods used in securing desired data were: (1) Individual, face-to-face, structured interviews, (2) Inspection of the college transcripts of these teachers, and (3) Administration and analysis of results of tests in economic content and attitudes, and in professional education information. Out of a possible 112 teachers in the sample universe selected, 100 were interviewed, and 40 voluntarily appeared at county centers to spend two and a half hours taking the tests.

Factors in the backgrounds of the teachers investigated through interviews and inspection of transcripts included socio-economic forces in the parental homes, current family status, the extent to which they possessed economic stakes, their work experiences, their secondary and college educations, and their professional experiences. In general their parental and current home backgrounds and patterns of living were middle-class and stable as measured by lack of broken homes, lack of mobility, estimated income levels, family size, and size of community.

According to test results the average teacher among the forty teacher-examinees is professionally well informed on general educational principles, teaching methods, and the sociology of education. He is less able in his knowledge of child development and adolescent psychology, and is weakest in regard to educational guidance and measurement. Ninety-five per cent of the teacher-examinees

achieved scores falling within the upper half of the normative distribution of responses established for the test items used.

The teachers responded with a consensus of opinion on 14 out of 20 items in the economic attitude test. Despite this, analysis reveals no internally consistent pattern for the group.

Considering that it has been an average of fourteen years since these teachers had their last formal training in economics, they achieved well in the economics content test in comparison with a control group of advanced economics students. They did best on items concerned with economic matters that have attracted public attention and with economic problems with which they themselves have had to deal in first hand experiences. They did poorly on items which called for technical terminology and generalizations in economics, especially those peculiar to the newer economic interpretations. The need for better in-service training programs covering these new economic viewpoints is indicated.

179 pages. \$2.35. Mic 56-3329

**AN ANALYSIS OF THE UNDERGRADUATE TRAINING PROGRAM FOR INDUSTRIAL ARTS TEACHERS IN FOUR SELECTED ILLINOIS TEACHER TRAINING INSTITUTIONS**

(Publication No. 18,722)

Dempsey Ellis Reid, Ed.D.  
Bradley University, 1956

The purpose of this study was to survey the industrial arts teachers who have graduated during the past five years from one of the four selected Illinois teacher-training institutions, analyze their training, and isolate apparent weaknesses in their educational background. The teachers were sent a questionnaire which was designed to obtain factual data as to the type of training the teacher received while in college, the types of shops in which they have taught, the subject areas they have taught, and other information regarding their teaching experiences. Also included in the questionnaire were questions that gave the teachers an opportunity to evaluate their college training and to express opinions and recommendations for the training of future industrial arts teachers.

The findings were tabulated according to the individual schools and not as a total group. No comparison was made of the training programs of the colleges except where the replies could be evaluated in terms of comparative curricular offerings of the schools.

The supervisors from the State Board of Vocational Education of the State of Illinois were also asked to express opinions and recommendations as to the general effectiveness of the college training programs. Their replies were used in combination with the teachers' replies as a basis for general conclusions and recommendations.

The summary of this study includes recommendations for each of the four participating colleges as to course content, course requirements, general college requirements, and the administrative planning for the industrial arts departments. The recommendations were made on the basis of the teachers' replies and in comparison with

the programs being offered at the present time by the colleges. The summary also includes general recommendations that might well apply to all colleges that offer an industrial arts teacher-training program.

135 pages. \$1.80. Mic 56-3330

**RELATIONSHIPS BETWEEN THE UNIVERSITY OF ARKANSAS CHILD STUDY PROGRAM AND CERTAIN ATTITUDES AND PRACTICES OF TEACHERS**

(Publication No. 16,962)

Ray L. Simpson, Ed.D.  
University of Arkansas, 1956

Major Professor: Jennie Lou Milton

The problem. The purpose of this study is (1) to describe the child study program currently conducted under the supervision of the University of Arkansas; (2) to determine if there is a significant difference in the teacher-pupil attitudes of child study and non-child study teachers; (3) to determine if there is a significant difference in the teacher-pupil attitudes of teachers who use and teachers who do not use certain commonly recommended teaching practices; (4) to see what changes in teacher-pupil attitudes, if any, occur as teachers participate in the University of Arkansas child study program during a three-week workshop, after one year, after two years, and after several years; and (5) to determine whether teachers whose professional training includes at least two years of participation in the University of Arkansas child study program tend to use more of certain commonly recommended teaching practices in their teaching than do teachers of comparable professional training who have not participated in this type of child study.

Source of data. Data concerning the child study program were secured from the files of the University of Arkansas and from interviews with leaders in the state identified with the child study program. Data relating to the use of commonly recommended teaching practices by fifty Arkansas teachers were obtained by questionnaire, classroom observations, and interviews. The Minnesota Teacher Attitude Inventory was used to secure data concerning the attitudes of teachers.

Statistical analysis. The T test, pre-test and post-test, and chi-square were used to test for significant statistical differences.

Summary. The University of Arkansas child study program emerged from local experiences and needs. Some of the distinguishing characteristics of the Arkansas program are: it is a continuous program integrating campus workshops with state, regional, and local activities; it is a voluntary program promoted to a major extent by local teachers; it is directly aimed at getting child development findings into operation in the classrooms; it emphasizes the keeping of an anecdotal record of one child throughout a year.

Teachers who have participated in the University of Arkansas child study program have more favorable teacher-pupil attitudes and use commonly recommended teaching practices to a greater extent than do teachers of a comparable amount of training without participation in a program of this type.

Teachers who use more of certain commonly recommended teaching practices have more favorable teacher-pupil attitudes than do teachers who use fewer of these practices.

There is a positive relationship between (1) improved teacher attitudes and practices of teachers who have progressively participated in the University of Arkansas child study program; and, (2) the keeping of anecdotal records and more favorable teacher-pupil attitudes.

Recommendations in connection with the use of child study practices in teacher education. It is recommended that:

(1) The University of Arkansas give consideration to continuing and strengthening the child study program.

(2) In teacher-education programs consideration be given to placing greater emphasis on the teaching practices of cooperative teacher-pupil sharing, planning, executing, and evaluating and flexible room arrangements and time schedules.

(3) Administrators, supervisors, and teachers seriously consider encouraging teachers to participate in child study activities, especially the writing of anecdotal records.

Recommendations for further research. It is recommended that studies be made to determine (1) other factors besides child study that contribute to the development of more favorable attitudes of teachers and to the use of commonly recommended teaching practices; (2) factors which hinder the development of more favorable attitudes of teachers and the use of commonly recommended teaching practices.

181 pages. \$2.40. Mic 56-3331

#### ORIGIN, DEVELOPMENT, AND OUTCOMES OF DRIVER EDUCATION IN MISSOURI

(Publication No. 17,909)

Robert Boulware Sonderman, Ed.D.  
University of Missouri, 1956

Major Adviser: Dr. H. H. London

##### Purpose of Study:

To trace the origin and development of driver education in the public secondary schools of Missouri and to ascertain the outcomes of this program.

##### Method of Research:

A study was made of all available material concerning the origin of driver education in Missouri and an information form was prepared to collect data relative to the development and status of the program. Individual test scores and driving records were examined to ascertain the outcomes of the program.

##### Summary:

The American Automobile Association was primarily responsible for the initiation of the program of driver education in the State of Missouri, with the program beginning in October of 1940.

Between the 1948-49 and the 1955-56 school years the number of programs in Missouri increased from 170 to 262.

School administrators reported that difficulty in class scheduling and cost of the program are the major problems in the further development of driver education in Missouri.

In Missouri at the time of this study, each student devoted an average of 21.5 hours to observing others driving behind-the-wheel, 9 hours to actual behind-the-wheel driving, and an average of two hours of classroom instruction per week for a period of 18 weeks.

The national average cost of driver education was thirty dollars per student, and the average cost per student in Missouri was \$37.58.

Almost 100 per cent of the schools granted credit toward graduation for driver education, but only 5 per cent of the schools required driver education for graduation.

Almost every school in Missouri offering driver education reported the use of a dual-control car, with about 95 per cent using a car equipped with a standard, straight shift transmission.

The instruction being offered seems to be lacking in the area of consumer information as applied to automobiles, their supplies and services.

The findings of this study seem to indicate that students who have had driver education training do not appear to have any better driving record than those who have not. Moreover, the findings contradict those of other studies, which concluded that driver education does reduce accidents by 50 per cent.

##### Recommendations:

Driver education instructors should evaluate their programs and give attention to improving them by including more informational content designed to produce owners and operators who are better informed, safer, and more frugal consumers of automobiles, their supplies and services, as well as to develop attitudes, skills, and habits necessary for safety minded, accident free, and law abiding drivers.

Instructors should make frequent follow-up studies of their graduates in an effort to ascertain the types of accidents and violations committed by these graduates so as to modify and improve instruction as the findings dictate.

School administrators should evaluate driver education programs to ascertain whether or not the time, energy and financial expenditures necessary for the operation of such programs are commensurate with the benefits attained.

Teacher training institutions should give attention to providing teachers of driver education who are aware of the present limitations of programs now operating.

150 pages. \$2.00. Mic 56-3332

#### GENERAL SHELLCRAFT

(Publication No. 18,724)

Otto Elliot Ursin, Ed.D.  
Bradley University, 1956

The purpose of this study is to produce a book on shellcraft that is suitable for self-instruction or as a guide for teaching the craft. The book is written in three parts. Part one is devoted to shellcraft information, part two to shellcraft processes, and part three to shellcraft projects.

Part one on shellcraft information includes illustrations and information that will be of interest and help in the procurement of shells and shellcraft materials. The

information is organized under the following topics: (1) some interesting facts about shells, (2) types of shells, (3) purchasing shells, (4) collecting shells, (5) shellcraft materials, (6) basic shellcraft tools, (7) shell storage.

Shellcraft processes are discussed in part two under ten headings: (1) cleaning shells, (2) dyeing shells, (3) drilling holes, (4) processing mother-of-pearl, (5) cementing, (6) finishing shells, (7) attaching cowry shells to a chain, (8) fabricating a base, (9) attaching a clasp to a chain, (10) making basic shell flowers. The above listed topics provide the information needed to prepare the shells for assembly into projects and for finishing the projects.

Part three includes a comprehensive list of project suggestions and directions for making twenty-six selected projects. Each project is illustrated, includes a list of necessary materials, and a step-by-step procedure for making the project. The projects were selected on the basis of the varied operations involved as well as suggestions that will stimulate ideas for designing other articles that can be made from shells. Material lists, step-by-step procedure, and illustrations are included for making projects such as brooches, cuff links, earrings, flower pots, key chain ornaments, mother-of-pearl inlay projects, lamps, necklaces, novelties, nut cups, pictures, place cards, and tie clasps.

The appendix contains a list of fifty-one specialized dealers in shells and shellcraft supplies. The instruction booklets listed are annotated, and they usually contain a listing of craft supplies sold by the writer, a few project suggestions, and brief instructions. The other books listed are manuals for shell collectors or books containing miscellaneous information on the shells of the world. The bibliography includes the materials that were of help to the writer in the preparation of this manuscript.

165 pages. \$2.20. Mic 56-3333

## EDUCATION, THEORY AND PRACTICE

### AN ANALYSIS AND SYNTHESIS OF RESEARCH RELATING TO SELECTED AREAS IN THE TEACHING OF ARITHMETIC (VOLUMES I AND II)

(Publication No. 18,774)

Chester Enoch Bartram, Ph.D.  
The Ohio State University, 1956

The purpose of the study was to analyze and synthesize significant research relating to selected areas in the teaching of arithmetic as a basis for critically examining teaching practices. The areas selected for consideration were: (1) arithmetic readiness, (2) scope of the arithmetic curriculum, (3) grade placement of content, (4) curriculum types, (5) general teaching methods, (6) procedures in fundamental operations, (7) problem-solving procedures, (8) instructional materials, (9) provision for individual needs, and (10) evaluation.

Approximately six hundred studies were screened, four hundred discarded as failing to meet the established criteria, and the remaining two hundred carefully analyzed

and reported. Studies were selected for analysis on the basis of the following criteria: (1) Was the experimental factor clearly restricted? (2) Were variations in pupil factors (intelligence, age, etc.) controlled? (3) Were non-experimental factors (instructional methods, materials, etc.) controlled? (4) Were the measuring instruments used valid and reliable? (5) Was the sampling adequate? and (6) Were the findings statistically significant?

In treating each area three procedures were followed: (1) identification and analysis of points of view concerning the area, (2) detailed presentation of research, and (3) forming conclusions and suggesting teaching practices. The more significant conclusions are summarized as follows:

1. Number readiness is a matter of degree and is operative at all grade levels and with all number learning experiences. Several interrelated factors (experience, intelligence, maturation, degree of understanding, and intrinsic purpose) influence readiness to learn arithmetic.
2. Considering the way children learn, specific arithmetic content should be spread out over a period of several years. Children cannot be expected to achieve full mastery within a given school year.
3. Arithmetic problem-solving is learned better through the medium of an activity program than through one more rigidly organized, and computational skills are learned equally well. In addition, activity programs contribute more to the child's social and emotional adjustment.
4. Regardless of the curriculum pattern followed, arithmetic instruction should be definitely planned. There is greater assurance that children will learn arithmetic when arithmetic learning experiences are provided and planned than when such experiences are left to chance.
5. Inductive methods are superior to deductive for teaching processes and generalizations.
6. Computational skills should be so presented that the sequential nature of the number system and the relationships within it are not violated.
7. Children profit from meaningful practice. Such practice should be motivated by a social need and should follow the acquisition of understanding.
8. Methods allowing children to use crude procedures, concrete materials, and crutches as they gradually gain mature competency in working with number are superior to methods which short-cut such procedures.
9. Cue words should not be used in teaching problem-solving. Instead, teachers should stress the meaning of the separate processes as well as their interrelationships so that children can think rationally in selecting the process to be used.
10. Problems which are real to the learner are more conducive to meeting the immediate needs of the pupil and more effective in promoting problem-solving ability than problems which are unrelated to the learner's life experiences.
11. A combination of the activity method and grouping within the classroom appears to be the most satisfactory means of meeting the needs of individual children.
12. Several techniques and devices (standardized tests, teacher-made tests, interviews, observations, and anecdotal records) have a key place in arithmetic evaluation.

475 pages. \$6.05. Mic 56-3334

**A STUDY OF CONCEPT LEARNING  
IN DIFFERENTIAL CALCULUS**

(Publication No. 17,043)

Sarah Maybelle Burkhart, Ph.D.  
Columbia University, 1956

This study is a philosophical experiment in concept learning in differential calculus. It examines the nature of the basic concepts of differential calculus and their formation. It investigates the preciseness of the concepts formed as a result of a concept-emphasized approach to the teaching of the calculus.

The examination of the nature of learning and the learning process and of the nature of concepts and their formation constitutes the preliminary considerations deemed basic to the experimental research of this study.

Mathematical literature was searched to determine the nature of and important aspects of the concepts of differential calculus. The aspects stressed and the definitions used in this study retain the preciseness and mathematical rigor required by students of advanced mathematics. The precise ideas of set, range, domain, and ordered pairs of numbers used by Veblen and Lennes in defining a variable and by Dirichlet in defining a function of a variable, ideas basic to the theory of a real variable in advanced mathematics, were used in this study. Likewise, the precise aspects of the epsilon-delta definition of the limit of a function and of continuity used by Cauchy in advanced mathematical theory were found to be within the grasp of students of elementary calculus. Because of brevity and lack of preciseness on the part of typical textbook writers in defining and explaining the basic concepts of the calculus, this study aims to present materials and methods to increase the understanding of the concepts as a means of improvement in learning in the calculus.

In the experimental portion of this study nine regular classes in differential calculus representing 235 students were used. Two classes were taught in the conventional manner with emphasis on skills and the solving of problems. The other classes were taught in the experimental manner with increased emphasis on understanding the concepts of the calculus.

Data for examining the preciseness of the concepts acquired by students in the experimental phases of the study and for evaluating the effectiveness of the concept-emphasized approach to teaching the calculus were obtained from teacher-made tests, from a standardized achievement test in differential calculus, from the Johnson test on retention in calculus, and from an investigation into pupil-success in subsequent courses in mathematics and in related subject-matter areas.

Comparison between the preciseness of the concepts acquired by students in the concept approach to the calculus and the preciseness of the concepts acquired incidentally by students in the skill approach to the calculus shows that the differences observed are primarily those of quality of concept. While the differences in distribution of excellent and adequate responses are significant for the concept of variable and for the applications of the calculus in solving problems, other differences point toward the effectiveness of the concept approach as a method of teaching the calculus. These differences suggest certain inferences examined as a supplement to this study (Appendix, Part I); namely, that increased emphasis on understanding the concepts of the calculus contributes toward improvement in learning, toward greater retention and toward in-

creased efficiency in the use of the calculus in related subject-matter areas. 230 pages. \$3.00. Mic 56-3335

**INDUSTRIAL EDUCATION IN SELECTED  
STATE SCHOOLS FOR THE DEAF**

(Publication No. 18,575)

Raymond Charles Doane, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. H. H. London

**PURPOSE OF STUDY:** The purpose of this study was to ascertain the status and need for industrial education at state schools for the deaf of the upper Mississippi Valley region.

**METHOD OF RESEARCH:** Check lists and interview schedules were prepared and used by the writer at seven schools for the deaf to ascertain the status of their industrial education programs. An information form was prepared and mailed to every male graduate of six graduating classes, 1950 through 1955, of the seven schools for the deaf. Another information form was prepared and mailed to employers of these graduates. Both forms contained questions concerning the occupational status of male graduates of schools for the deaf. Suggestions for the improvement of industrial education programs was requested.

**SUMMARY:** Teachers of industrial education reported old equipment as their major source of teaching difficulties.

Guidance and placement services had not been accepted as a functional part of the total educational program.

More than one-half of the graduates reported that they were employed in the trade for which they were trained.

While the mean salary of employed graduates of 1955 was \$2,624, mean salaries increased yearly to \$4,076, for 1950 graduates.

Approximately four-fifths of the employers rated graduates as good to excellent employees.

Approximately four-fifths of the employers indicated that hearing and language deficiencies had not been a hindrance to job performance or efficiency on the job.

While graduates considered "more trade facts and knowledge" as being needed most to advance on the job, employers believed the development of personal-social traits was needed most.

Chief among the suggestions made by graduates and their employers for the improvement of training programs were: establish better training for the development of desirable personal-social traits, mental health, physical fitness, and employee attitudes; place more emphasis upon the development of oral speech, speech reading, complete sentence structure in written, sign, and spoken communications; placement and follow-up services, and aids designed to help employers be more receptive to deaf workers; organize training to include instruction in the operation, care, maintenance, mechanical principles of a variety of up-to-date machines' provide coordinated in-school and on-the-job training situations in trades for which there are job openings; add such trade courses as auto body repair, machine

shop, dry cleaning, painting, electricity, drawing, and plumbing; and provide more training for development of specialized skills for specific job openings. By contrast, they also suggested the development of a greater variety of skills in a family of trades.

**CONCLUSIONS:** The occupational success of graduates of schools for the deaf, in the trade for which they were trained, compares favorably with hearing employees who have been employed on similar jobs for approximately the same length of time.

Teachers and administrators should seek arrangements to provide for on-the-job training.

An organized placement service should be provided by these schools.

A more functional in-service teacher education program should be promoted.

Appropriate budgetary policies need to be established to provide for greater salaries of industrial education teachers and for up-to-date facilities.

On the basis of the occupational success of graduates of schools for the deaf, in occupations for which they were trained, it seems that employers need not be reluctant to employ other graduates who have had sufficient training.

Employers should understand that the individual has more to do with what he will do on the job than his handicap prevents him from doing.

258 pages. \$3.35. Mic 56-3336

#### A CONTENT ANALYSIS OF FILMS DEALING WITH EDUCATIONAL GUIDANCE IN HIGH SCHOOL

(Publication No. 19,270)

Aurelio Obedoza Elevazo, Ed.D.  
Indiana University, 1956

Chairman: Carolyn Guss

##### The Problem

The main purpose of the study was to determine the extent to which certain selected films include content ideas which are contributive to educational guidance objectives in high school. The following were the major questions for which answers were sought:

1. To what extent are the identified content ideas in a given film or in a group of films contributive to specified objectives of guidance? Which objectives are best served by the films?
2. How are the ideas portrayed? To what extent is presentation of ideas made by means of the narration, of the visuals, or of both narration and visuals?
3. What types of ideas do the films include?

##### The Procedure

The analysis consisted of (1) defining the objectives of educational guidance in high school; (2) developing an analysis schedule through a pilot study; (3) selecting the sample of films; (4) analyzing each film in accordance with the analysis procedure developed in the pilot study; and (5) analyzing the data thus gathered.

The objectives were based on a survey of relevant literature and on the investigator's knowledge and experience. Validated by six guidance experts, the list of objectives included six main categories and 42 specific ones.

*The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.*

The analysis procedure followed in the pilot study required the construction and use of a guide for identifying content ideas in films, a set of criteria for determining when a content idea may be considered as contributory to an objective, and an analysis schedule - all of which were tested for validity and reliability. The film, High School: Your Challenge, was used in the pilot study. In accordance with the analysis procedure established from the pilot study, 19 randomly selected guidance films were analyzed and the data thus gathered were examined.

##### Results of the Study

The data revealed that the films contained ideas which were contributive to the realization of most of the specific objectives. The films were found to be mostly contributive to the development of good habits of work and study on the part of the student. The majority of the identified ideas (1) appeared to be contributory to the student's adjustment to his educational environment; (2) failed to deal with certain ones of the listed objectives; (3) were contributive to the development of self-direction on the part of the student; and (4) showed the counselor's role, although with very slight emphasis, as one of a helpful and sympathetic friend who is willing at all times to provide guidance to the end that students can make their own decisions and execute their own plans.

For every 100 identified ideas, there were 28 in the narration, two in the visuals, and 70 in both narration and visuals. It is traditionally believed that the greater the harmony between narration and visuals in a film, the more likely that the film will be effective. However, the data just mentioned are not presented as basis for determining the extent to which these film elements must be used to portray ideas.

The most predominant type of ideas was in the form of "methods" of doing certain specific things related to school work. Opinions, facts, cause-effect situations, and principles were also identified in relatively small and varying quantities. Principles were used least - the ratio being one principle to 250 other ideas.

It was also found from the literature dealing with guidance that although a few writers recognize the possibilities of film use especially in vocational guidance, the majority of the authors do not mention films at all. The role of films dealing with educational guidance was not sharply defined by those who recognize the relevance of films to guidance work.

349 pages. \$4.50. Mic 56-3337

#### STATUS OF AND NEED FOR TERMINAL VOCATIONAL-TECHNICAL CURRICULA IN SENIOR COLLEGES AND UNIVERSITIES

(Publication No. 18,576)

Richard Earl Fisher, Ed.D.  
University of Missouri, 1956

Supervisor: Dr. H. H. London

**PURPOSE OF STUDY:** To ascertain the status of and need for terminal vocational-technical curricula in senior colleges and universities, and what factors contribute most to the development and popularity of such curricula.

**METHOD OF RESEARCH:** Information forms containing data pertinent to the study were received from 78 colleges and universities in 39 states. Literature in the field of junior and senior college organization and administration including college bulletins and catalogues was reviewed for information and data bearing on the topic. The data were tabulated by hand and arranged in tables for convenient presentation throughout the study.

**SUMMARY:** About 9 per cent of the total college enrollment of the institutions studied was enrolled in terminal vocational-technical curricula.

Secretarial Science and Industrial Education represent the subject fields most commonly served by terminal curricula.

Eighty-six per cent of all schools studied required a high school diploma as an entrance requirement to their terminal curricula.

The majority of schools conducted all phases of their program on a single campus under the academic leadership of the same dean.

It appeared that on the campuses of most institutions studied there was a tolerant and democratic attitude among all students as expressed by the response, "entirely accepted regardless of curriculum or major."

Faculty members at institutions where terminal curricula are offered appear to have mixed feelings in the matter. Some expressions of these feelings were, "not a job for senior colleges and universities," and a good example of democracy in action."

Of the 35 public supported schools included in the study, four reported that they were using federal vocational education funds for the support of their terminal curricula.

The ratio of well trained technicians to professional engineers as needed in industry appears to have been steadily rising from about 3 to 1 in 1926, to perhaps 20 to 1 in certain highly specialized industries at the time of this study.

Enrollment trends indicate that by 1970 college and university campuses will be bulging with students, many of whom can be best served by carefully planned terminal vocational-technical curricula.

**CONCLUSIONS:** Most educators agree that two of the most pressing educational needs of college age youth are (1) education for satisfactory employment, and (2) education for effective citizenship. Based on the findings of this study it would appear that terminal vocational-technical curricula of college grade have, where offered, provided for these needs in a commendable way.

The factors which contribute most to the development and popularity of terminal vocational-technical curricula in senior colleges and universities appear to be (1) the prestige of a senior college, (2) senior colleges provide beginning students with time and information necessary to make intelligent educational choices, (3) social attractions afforded by a senior college, and (4) quality of instruction provided at a senior college.

The small number of public supported institutions which availed themselves of federal vocational funds would suggest a lack of information or indifference on the part of school administrators.

Senior colleges and universities in general throughout the country appear to be too busy with degree programs and graduate departments to give the time or

attention necessary for the development and promotion of terminal curricula. Many more of the educational leaders seem ready to voice their sentiments and sympathies in favor of terminal curricula than appear willing to take the risk of additional expense, complicated administration, and academic reproach that might be involved in actually offering this type of program.

166 pages. \$2.20. Mic 56-3338

#### A SURVEY OF THE EDUCATION OF THE INDIANS OF MEXICO AS A FACTOR IN THEIR INCORPORATION INTO MODERN MEXICAN SOCIETY

(Publication No. 18,496)

James Lathrop Garrard, Ph.D.  
University of Washington, 1956

This thesis proposes to study some of the educational attempts that have been made by, and for the benefit of, the Indians of Mexico, and how this education has helped to draw these Indians into Mexican society, instrumenting the integration of that country.

For an adequate understanding of the field it has been deemed necessary to establish certain anthropological concepts that have been vital in the development of the education of the Indians, and to present some of the historical and cultural aspects of their lives.

The development of the education of the Indians has paralleled social changes leading toward the eventual industrialization of Mexican society. The Revolution of 1910 was but a phase of these changes. Even before that disturbance there had been a growing realization by many scholars of an existing so-called "Indian problem" due to the mental and physical isolation of the Indians, and their previous neglect by the Mexican nation. Concentration upon the Indian problem has shown that it prevails in the realms of the Indians' health, economy, and education. Since the Indian problem is complex, so also is its solution, and this must be attained from at least the three sides mentioned above. The education of the Indians is the phase of that solution studied in this thesis, and a phase which touches all other aspects of the Indian problem.

The education of the Indians of the pre-Conquest era is examined as a background, and also that of the Colonial Period missionaries, who used principles which were later disregarded and still later revived as bases for present educational attempts. The initial post-revolutionary educational system - the "House of the People" - uncovered needs which were in part met by the Cultural Missions, and by experiments such as at Carapan, at the "House of the Indian Student," and the Boarding Schools. Further development brought forth organizations for the specific aid of the Indians, together with the Communities of Indian Development, the Coordinating Centers, and the Literacy Programs, and also the work of UNESCO at Patzcuaro and in the State of Nayarit.

An attempt to judge the efficacy of the education of the Indians in fusing them into the Mexican nation makes use of data from the national censuses of that country for the years 1930, 1940, and 1950. In the fields of literacy, bilingualism, diet, health and sanitation, housing facilities, clothing, occupations, urbanization, and religion, it is shown that there have been significant culture changes in the ten "Indian States," and a general unification of culture

in Mexico as a whole. A portion of this "incorporation" is attributable to the education of the Indians.

During the preparation of this thesis additional areas of possible study pertaining to the Indians of Mexico suggested themselves. These fields, listed in the Appendix, could be investigated advantageously. For that reason the Bibliography contains pertinent references which have been added to those cited in the thesis.

310 pages. \$4.00. Mic 56-3339

#### TEACHER-DEMONSTRATIONS VERSUS SHOP ACTIVITIES IN THE TEACHING OF ELECTRICITY: AN EXPERIMENTAL COMPARISON

(Publication No. 18,582)

John Leslie Johnston, Ed.D.  
University of Missouri, 1956

Supervisor: H. H. London

**PURPOSE OF STUDY:** The purpose of this study was to ascertain the relative superiority of teacher demonstrations and shop activities in the teaching of general electricity on the college level.

**METHOD OF RESEARCH:** Data for the study were obtained by experimental comparison of the two instructional methods in a college teaching situation. Six classes were divided into two groups which studied the same informational content but were taught differently by the same instructor.

**POPULATION STUDIED:** The experiment involved 106 college students of general electricity and was continued over a period of two school years.

**OUTCOMES MEASURED:** For purposes of comparing educational outcomes, 38 pairs of students were matched on mental ability and initial status in the subject. Informational achievement was measured by means of a subject-matter test administered at the completion of the course.

Expense was ascertained by comparing the costs of materials, equipment, facilities, and other factors involved in the use of the two methods.

Effort required on the part of the instructor when teaching by each of the two methods was measured by an analysis and comparison of factors involved in the preparation for and the teaching of the classes.

The Remmer's, Scale for Measuring Attitude Toward Any School Subject, was used to measure the relative attitudes of the two groups of students toward the course when taught by the two methods.

**FINDINGS:** Insofar as the acquiring of information was concerned, the teacher-demonstrations were found to be superior to shop activities as used in the study.

With respect to the cost of teaching the course by the two methods, the expense involved in the use of the demonstration method was found to be less than that of the shop activity method and was, therefore, judged superior to it as used in this study.

In terms of the effort required on the part of the instructor, the demonstration method was found to be superior to the shop activity method.

No significant difference was found to exist between the two groups as to attitudes expressed toward the subject when taught by the respective methods.

**CONCLUSIONS AND IMPLICATIONS:** As defined and used in the study, and in terms of the stated criteria, teacher-demonstrations of electrical principles and applications are superior to, or more effective than, shop activities in the teaching of general electricity to industrial education students at the college level.

Even though the difference in informational achievement was statistically significant, it was not large and both groups developed satisfactorily.

The costs of projects completed in classes involved in the study were quite moderate and should not be considered a serious limitation of the shop activity method.

Inasmuch as a good composite general shop, with the addition of some special tools and electrical equipment, would provide adequate facilities for teaching electricity in an industrial arts program, the cost of equipping a shop should not be a serious deterrent to including shop activities in an electrical program.

If shop activities are to be employed in the teaching of electricity, continued effort needs to be directed toward the development of new and more appropriate projects and instruction jobs.

If shop activities are to contribute greatly to the understanding of electrical principles and their applications, some procedure, in addition to the mere performance of the manipulative operations, must be employed to help insure such outcomes.

Consideration should be given to the inclusion of more demonstrations of principles and applications in the teaching of electricity.

210 pages. \$2.75. Mic 56-3340

#### FACTORS RELATED TO PERSISTENCE IN OCCUPATIONAL CHOICE IN HIGH SCHOOL

(Publication No. 17,322)

Albert Herman Krueger, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor John W. M. Rothney

This study was designed to determine the relationships between persistence of occupational choices of high school students over a three-year period and the following fifteen kinds of psychological and sociological data.

1. Socio-economic status.
2. Father's occupation.
3. Intelligence test scores.
4. Verbal-meaning test scores.
5. Number test scores.
6. Rank in graduation class.
7. Sex.
8. Size of city of residence.
9. Acceptability of school behavior.
10. Pupil's concept of self as revealed by a self-rating scale.
11. Desire to work independently.
12. Persistence in best-liked subject.
13. Persistence in least-liked subject.
14. Kind of occupation chosen in sophomore year.
15. Work experience or work training.

In order to determine the relationship between the fifteen selected factors and persistence in occupational choice, data from one of the most extensive counseling studies yet undertaken were employed. This study, known as the Wisconsin Counseling Study and concerned ultimately with the prediction of post-school performances of 690 high school youth, was conducted under the sponsorship of the Social Science Research Committee of the University of Wisconsin. Only those 302 subjects of the experimental group whose records contained sufficient information on the fifteen factors listed above were used.

The 302 subjects of the Wisconsin Counseling Study had received intensive counseling during their last three years of high school. Their occupational choices for each of those three years were determined during interviews. It was possible to place each of them into one of three categories of persistence in choice. The numbers in each category follow: eighty-six were never persistent, 111 were persistent in two choices, and 105 were persistent in three choices.

To determine the relationship between the fifteen selected factors and persistence in occupational choice three measures were used: (1) chi square test of goodness of fit; (2) analysis of variance for factors yielding continuous numerical scores; and (3) critical ratios. Only three of the fifteen factors were found to discriminate between persistency groups to justify their use in forecasting persistency of occupational choice. The three factors were father's occupation, number test score and the kind of occupation chosen during the sophomore year.

For prediction purposes, the 302 cases in this study were split by means of alphabetical sampling into two similar groups. A prediction equation was derived from the data on one half of the total group.

The prediction equation was used to predict the persistency of vocational choices of the other half of the 302 cases. The following percentage of correct predictions were obtained in the three persistency groups: fifty-eight per cent correct predictions were obtained in the "never persistent" group, forty-four per cent correct predictions were obtained in the "two choices persistent" group, and nineteen per cent correct predictions were obtained in the "three choices persistent" group. The overall percentage of correct predictions obtained for all three groups was 39 per cent. The relationship between actual and predicted scores was statistically significant.

A study of fifteen cases from the Wisconsin Counseling Study revealed that factors other than the ones employed in the statistical study might be related to persistence in occupational choice. The evidence obtained from the statistical and case methods indicated that persistence of occupational choice because of its complexity, could not be predicted accurately by statistical methods now available.

151 pages. \$2.00. Mic 56-3341

#### A STUDY OF THE EFFECT OF THE LENGTH OF THE HIGH SCHOOL ENGLISH CLASS PERIOD ON ACHIEVEMENT IN ENGLISH

(Publication No. 18,587)

George Edwin Mowrer, Ed.D.  
University of Missouri, 1956

Supervisor: John L. Ferguson

**PURPOSE:** To investigate the effect that the length of the high school class period in English has on achievement in English.

**METHOD OF RESEARCH:** An analysis was made of two groups of girls and of two groups of boys. Grouping was made on the basis of the length of the high school class period during which the girls and boys studied English I, II, and III. Girls and boys who studied high

school English in periods of less than fifty minutes in length were designated the short period groups. Girls and boys who studied high school English in periods of fifty minutes or more in length were designated the long period groups.

Ability was established for the two groups of girls and also for the two groups of boys in accordance with scores on the Ohio State University Psychological Examination, Form 23.

Achievement was determined by grades in the first semester of English at the University of Missouri, and scores on the Cooperative English Test A: Mechanics of Expression, Form S and the Cooperative English Test B2: Effectiveness of Expression, Form S.

The achievement of the short and long period groups of girls and also the achievement of the short and long period groups of boys were examined by analysis of variance and by analysis of covariance. The .01 level of significance was required for establishing statistical significance.

#### SUMMARY:

- (1) By analysis of variance it was established that the short and long period groups of girls and also the short and long period groups of boys did not differ significantly in ability as ability was measured by the Ohio State University Psychological Examination, Form 23.
- (2) By analysis of variance and analysis of covariance it was established that the short and long period groups of girls and also the short and long period groups of boys did not differ significantly in achievement as achievement was measured by grades in the first semester of English at the University of Missouri and by scores on the Cooperative English Test A: Mechanics of Expression, Form S and the Cooperative English Test B2: Effectiveness of Expression, Form S.

**CONCLUSIONS:** From the analysis of the data gathered for and within the limitations of this study, it may be concluded that the length of the high school class periods is not a significant factor in the achievement of students in English, as such achievement is represented by the performances of the students used in this study on the Cooperative English Test A: Mechanics of Expression, Form S, the Cooperative English Test B2: Effectiveness of Expression, Form S, and by grades received by these students in the first semester of English at the University of Missouri.

136 pages. \$1.80. Mic 56-3342

#### COMPARISON OF TWO APPROACHES TO THE TEACHING OF SELECTED TOPICS IN PLANE GEOMETRY

(Publication No. 18,178)

Eugene Douglas Nichols, Ph.D.  
University of Illinois, 1956

Two methods are generally employed in the acquisition and communication of knowledge - induction and deduction. Their relative effectiveness in terms of teaching is of vital

concern to those engaged in teaching. The purpose of this experimental study was to assess the effectiveness of learning of certain geometric topics as related to the method by which they were taught. The two methods under experimental investigation were: the dependence approach, falling in the category of what is generally considered to be deductive method, and the structured search approach, falling in the category of inductive methods.

Students taught by the dependence approach depended on the teacher for statement of assumptions, theorems, definitions, and verbalization of principles. Students taught by the structured search approach discovered every relationship through a series of concrete experiences with drawings of geometric figures and through mensuration. The experiences leading to discoveries of these relationships were structured through teaching materials, called experiments. Every class session was recorded in detail by an observer and by the use of taperecorder.

Two groups of twenty-one students each, matched on the criterion test score, I.Q., sex, and age were used as subjects. Each group was taught by three teachers. The effectiveness of a method was assessed in terms of the amount of growth in knowledge of vocabulary, critical thinking ability, ability to solve problems, and fundamental skills, as measured by the criterion test.

On the basis of the obtained empirical data, analyzed by the use of variance and covariance techniques, the following conclusions were reached:

1. The structured search approach and the dependence approach are equally effective in terms of the criterion test in teaching plane geometry to high school freshmen.

2. The structured search approach and the dependence approach are equally effective in terms of the criterion test in teaching plane geometry to high school freshmen with superior I.Q.'s.

3. The structured search approach and the dependence approach are equally effective in terms of the criterion test in teaching plane geometry to high school freshmen with average I.Q.'s.

4. The difference in effectiveness of the structured search approach in terms of the criterion test in the teaching of plane geometry to the high school freshmen with superior I.Q.'s and the freshmen with the average I.Q.'s does not differ significantly from the difference in effectiveness of the dependence approach in the teaching of plane geometry to the high school freshmen with superior I.Q.'s and the freshmen with the average I.Q.'s.

172 pages. \$2.25. Mic 56-3343

#### TEACHER OPINION CONCERNING ABILITY RECOGNITION

(Publication No. 19,279)

Mack A. Ralston, Ed.D.  
Indiana University, 1956

This study was designed to examine the opinions of a selected group of beginning teachers with respect to the identification and rewarding of outstanding teachers.

The teachers selected for the study were those who had one to four years of experience and who had been evaluated by their administrators at the end of the first year of teaching. A composite score was determined for each teacher

on the basis of these administrative ratings. The teachers were then ranked on the basis of these scores. Those teachers who ranked in the upper third were considered better teachers and those in the lower third poorer teachers for the purposes of this study.

A questionnaire was used to examine the opinions of the better and poorer teachers with respect to the activity of ability recognition. The purposes of ability recognition were stated as: (1) To stimulate teachers through a definition of goals and activities representing the higher levels of achievement; (2) to help the individual teacher by recognizing areas of strength in his teaching, and by encouraging activity to strengthen other areas; and (3) to recognize excellent teaching wherever it may exist, regardless of age, sex, or position. Teachers were asked if a difference in teaching ability existed, if that difference could be identified, who could identify it, and how it should be rewarded.

One hundred fifty-one teachers returned usable questionnaires. Eighty were received from poorer teachers and 71 from better teachers. Replies were mailed from 20 states.

Over 95 per cent of the teachers responding felt that a difference in teaching ability did exist. Only one respondent was undecided about this question. Approximately 82 per cent of the respondents felt that they had been able to identify differences in teaching ability, and approximately 88 per cent felt that this difference could be identified.

Almost 70 per cent of the respondents felt that teachers could cooperatively identify outstanding teachers, while approximately one-fourth of those responding were undecided about this. Almost 48 per cent of those responding felt that administrators could identify outstanding teachers, while a little more than one-third felt that they could not. However, slightly more than 71 per cent felt that administrators and teachers cooperatively could identify outstanding teachers. Almost 50 per cent of the better teachers and slightly less than 44 per cent of the poorer teachers felt that lay persons could contribute to this identification. Slightly more than one-fourth of the respondents were undecided about the ability of lay persons in this respect.

Approximately 75 per cent of the teachers studied responded to questions concerning the manner in which this outstanding teaching should be rewarded. Of the group who responded: (1) Slightly less than half felt that salary bonuses should be given for outstanding teaching; and (2) almost two-thirds felt that promotions to positions of greater responsibility should be given. Almost a third of the respondents were undecided about bonuses, and slightly less than one-fourth were undecided about promotions. Approximately one-half did not favor the use of titles (such as master teacher) as a form of reward, while slightly more than one-fourth did.

The study revealed no apparent difference in the attitudes of poorer and better teachers with respect to the activity of ability recognition. The marital classification of the respondents did not seem to color their opinions. The responses of men and women teachers did show a significant difference. Men teachers felt more frequently than women teachers that outstanding teachers should be rewarded, and women teachers felt more frequently than men teachers that lay persons could contribute to the identification of outstanding teachers.

87 pages. \$1.50. Mic 56-3344

**THE VOCATIONAL MACHINE SHOP PROGRAM  
IN ILLINOIS: A FOLLOW-UP STUDY OF  
GRADUATES AND EMPLOYERS**

(Publication No. 18,721)

Wayne S. Ramp, Ed.D.  
Bradley University, 1956

This study attempted to discover the extent to which the vocational machine shop program in the state of Illinois had been successful in meeting its stated objectives. Secondary problems involved an attempt to discover: (1) which objectives of the vocational machine shop program had the most value in the opinion of the graduates of this program, (2) employers' attitudes and opinions pertaining to the vocational machine shop program and its graduates, (3) the possible need for strengthening the vocational machine shop program in certain areas.

Data were obtained from a survey of former vocational machine shop students who graduated from thirty-five schools in downstate Illinois in the years 1952, 1953, and 1954. Further information was solicited from employers of the graduate respondents.

Questionnaire forms were designed to elicit responses indicating the degree to which graduates and their employers felt vocational machine shop training had been of value. Included in both the graduate and employer questionnaire forms was a check list of forty-eight items directly related to the official stated objectives of the vocational machine shop program in the state of Illinois. These items referred to skills, knowledge, and character traits. Graduates indicated which of these attributes they considered to have been of much value, while employers rated graduates under their supervision either "weak," "strong," or "no opportunity for observation in this respect."

Contact was made with 840 graduates and 439 employers by mailed questionnaire. This resulted in usable returns from 480 graduates and 248 employers for a response of 57.1 percent and 56.5 percent respectively.

Data from returned questionnaires were tabulated in one of five categories according to the type of occupation in which the graduate was currently engaged. These groups were (1) working in the machinist trade, (2) working at some occupation other than the machinist trade, (3) engaged in military service, (4) attending college or trade school, and (5) unemployed.

It was concluded that the objectives which had been reasonably well achieved pertained to (1) machine shop skills, (2) knowledge of basic processes, (3) desirable social and moral qualities, (4) craftsmanlike habits and attitudes, and (5) safety. It appeared that the objectives applying to (1) correlation of academic subjects with machine shop training, (2) knowledge of interrelationships of crafts, (3) economics, (4) placement and follow-up activities of the school, (5) information of further training opportunities, (6) employer-employee relationships, (7) state and federal agencies, and (8) labor laws probably had not been sufficiently attained.

Objectives which apparently had the most value for the graduate respondents were those which involved (1) safety, (2) skills, habits and attitudes, (3) character development, (4) basic mechanical principles and processes, and (5) related information dealing with the conventional "three R's."

There seemed to be evidence indicating that most

graduates and their employers were well satisfied with the vocational machine shop program, irrespective of whether the graduate was working in the machinist trade.

Recommendations, based on the findings and conclusions, concerned such matters as (1) current status of the vocational machine shop program, (2) reappraisal of objectives, (3) school-industry contacts, (4) criteria by which the success of a vocational machine shop program might be evaluated, (5) expansion of the program, (6) pre-military (education), and (7) suggestions for further study.

227 pages. \$2.95. Mic 56-3345

**A STUDY OF CERTAIN SUPERVISORY  
PRACTICES IN THE SCHOOLS OF  
TEN WISCONSIN COMMUNITIES**

(Publication No. 17,341)

Otto James Shipla, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Burton W. Kreitlow

**I. State of the Problem**

The problem in this study was to determine possible differences in supervisory practices in two types of school districts. The following hypothesis was tested: There is no differences in a program of supervision of teachers in reorganized school communities and in non-reorganized school communities.

**II. Procedure or Methods**

This research concentrated on a study of supervision in five reorganized school communities and in five non-reorganized school communities during a four-week period.

All supervisors in the ten areas were involved, as were all teachers; but a random sample of six teachers in each community was chosen for more intensive study. Supervisors were interviewed prior to log-keeping. Supervisors and teachers kept a month's log of supervisory experiences during the month of October. The random sample of teachers in each community was interviewed after the log-keeping.

An analysis of data was made in two parts: Part I - The Extent of Supervision, and Part II - Characteristics of Supervision. Characteristics of Supervision were analyzed inasmuch as a supervisory practice must be considered in terms of the personnel involved, the philosophy, the principles, and the situation. Davies' statistical tables were applied to the raw data.

**III. Results**

In "extent of supervision" it was revealed there are statistically significant differences in favor of reorganized school communities at the 1% level in (1) amount of time that teachers are observed in classroom teaching, (2) frequency that teachers in their classroom activities are observed by supervisors, (3) frequency of individual teacher-supervisor conferences, (4) frequency of group conferences involving teachers and supervisors, (5) number of instructional problems recognized by supervisors, (6) number of oral and written reports which teachers receive from supervisors, and (7) in the total number of

contacts between teachers and supervisors. Teachers in reorganized school communities also spent more time in individual teacher-supervisor conferences, significant at the 5% level.

In a consideration of the personnel, the only significant difference between the two types of communities analyzed in this study showed that in reorganized districts teachers in "new" positions receive more supervisory help than teachers who are not spending a first year in a certain position.

In terms of philosophy, observation indicated more patterns of agreement between teachers and supervisors in reorganized school communities.

Analysis of basis of supervision on democratic principles indicated (1) greater number of problems with which teachers receive help, (2) lesser number of instances where teachers received no help, (3) lesser number of instances where teachers thought supervisors were too critical at the 1% level of significance to the advantage of reorganized school communities. Reorganized communities were also favored in lesser number of instances where group conferences were not planned by teachers. There was no difference between the two types of school communities in five other factors concerned with democratic principles, such as a teacher's invitation to a supervisor to visit a classroom.

Supervisors provided professional literature for more teachers in reorganized school communities (significant at the 1% level). Results of this study indicated that for ten other factors categorized under "certain selected characteristics of supervision" there was no difference between the two types of school communities.

#### IV. Conclusions

The study has produced evidence that there are differences in programs of supervision of instruction in reorganized school communities and in non-reorganized school communities. Most of these differences are found in the extent or amount of supervision. When the personnel, philosophy, and certain other characteristics of supervision are considered, there are fewer differences. Therefore, although there are indications that a supervisory program in reorganized districts is "better" (in that it fosters greater pupil growth) such a conclusion must be held with reservation because of the personnel, principles, and philosophy involved in a particular situation. Although the null hypothesis is rejected, further study and statistical analyses are necessary to produce more conclusive evidence.

502 pages. \$6.40. Mic 56-3346

#### TEACHING SOCIAL-CIVIC RESPONSIBILITY IN THE ELEMENTARY SCHOOL

(Publication No. 18,558)

Lloyd Lowell Smith, Ph.D.  
State University of Iowa, 1956

Co-chairmen: Professor Herbert F. Spitzer  
Professor John H. Haefner

Research at the State University of Iowa during the past thirty years has drawn attention to the fact that many

of the social behaviors necessary for living successfully with other people are defined by law. In addition, it has been found that the requirements stated by law are not well-understood by either elementary pupils or adults. It has therefore been advocated that units of instruction dealing with the requirements of the law be included in the elementary school social studies curriculum.

The major purposes of the present study were three in number:

1. To determine present-day elementary school pupils' understanding and appreciation of certain selected legally-correct behaviors necessary for living successfully with other people;
2. To construct materials and define teaching methods to be used in systematic instruction concerning legally-correct behavior in social situations;
3. To evaluate the adequacy of the materials and methods for use in public elementary schools by using them experimentally in public school classrooms.

The three areas chosen for investigation were trespass, lost and found, and slander, each of which is governed by specific laws.

Materials for teaching a series of fifteen lessons, five in each area, were constructed and incorporated in a teachers' manual. Included in the manual were: (1) Background information about the law; (2) Methods of teaching to be used; (3) Illustrative lessons; (4) A single-page outline for each lesson; and (5) The court decision upon which each lesson was based.

Also constructed were objective tests of concepts and attitudes felt to be important in the types of situations dealt with by the instruction.

Seventy elementary classes at second, fourth, and sixth grade levels from seven school systems in Iowa and Minnesota participated in the study. Each class was tested at the beginning of the experiment. Commencing one week after the initial test, each of the forty experimental classes was taught the series of lessons at the rate of one each week. During the fifteen-week period the thirty control classes had no special instruction. One week after the completion of the experimental teaching, the initial test was re-administered to all classes.

Evaluation of the teaching utilized both pupil test scores and teacher responses to a questionnaire. The analysis of covariance was used in analyzing the test scores, the five per cent coefficient of risk being employed in testing the null hypothesis.

At all three grade levels, the experimental classes scored significantly higher on the final test than the control classes. In addition, teacher responses indicated acceptance of the lessons as being both worthwhile and necessary. An overwhelming majority of the teachers felt that materials of the sort used in the experimental teaching should be a regular part of social studies instruction.

In view of the findings, the following major conclusions seem warranted:

1. The tests used in the study appear to be sufficiently reliable and valid for purposes of measuring achievement in the three areas.
2. The concepts and attitudes included in the tests are not well-learned before instruction by elementary pupils at any of the grade levels included in the study.
3. There is a significant improvement in pupils' test scores during a period of systematic instruction such as was a part of the study.

4. The materials used in the study are of such a nature as to be usable materials in the public elementary school situation. Most teachers felt that the lessons were interesting to pupils and a valuable addition to the social studies curriculum. The materials constructed for teacher use were judged by the teachers to be of definite assistance in planning and conducting the lessons.

432 pages. \$5.50. Mic 56-3347

**AMERICAN EDUCATION: A CRITICAL ANALYSIS OF ITS POSSIBLE IMPLICATIONS FOR NIGERIAN EDUCATION**

(Publication No. 18,723)

Ernest N. Ukpaby, Ph.D.  
Bradley University, 1956

The purpose of this study was to formulate a philosophy for Nigerian education. The source of inspiration was the American educational system - its theory and practice.

**METHOD**

Since American education operates in the context of democracy it was thought worthwhile to examine education and democracy as problems *sui generis*, that is, each as a problem in itself without relation to either America or Nigeria. This approach enabled the writer to consider education and democracy as ideals expressed by a number of other writers. It was believed that a glimpse of such ideals would give perspective to the examination of the American system, and therefore afford a more reliable background for attempting the formulation of a philosophy for Nigerian education.

Four educational philosophies considered common in America were examined with special emphasis on their basic assumptions, learning theories, curriculums, and methods of social control. After this, the administrative, supervisory, and teaching techniques in American educational process were analyzed. With this background, and bearing in mind the nature of Nigerian culture and that of the world in which we live, an attempt was made to formulate a philosophy for Nigerian education.

**CONCLUSIONS**

The study led to the formulation of a philosophy which, while recognizing the need for cultural or social orientation as a function of education in Nigeria, particularly at the elementary and secondary levels, insists on cultural self-transcendence as the ultimate goal of education in the modern world. Certain aspects of American theories and practices were found to be inadequate and therefore were rejected for incorporation with the Nigerian system. For instance, while recognizing the need for community participation in the education of youth, the tendency for the community to run the school was thought inadvisable. Similarly, there was hesitation in accepting the tendency toward gregarious standardization and excessive freedom without sufficient emphasis on responsibility.

It was held in this study that the basic concepts on which a philosophy of education was to be constructed were

the notions of Man, God, and the Universe. The practical implications of the philosophy suggested here for Nigerian education were expressed with regard to ten particular issues - authority, communication, cooperation, faith in human nature, heredity, individual differences, punishment as a control, subject matter dominance, teacher dominance, and tension and relaxation.

150 pages. \$2.00. Mic 56-3348

**AN EXPERIMENT IN TEACHING DEVELOPMENTAL READING IN THE JUNIOR HIGH SCHOOL AT MEXICO, MISSOURI**

(Publication No. 18,596)

William Joseph Underwood, Ed.D.  
University of Missouri, 1956

Supervisor: A. Sterl Artley

**PURPOSE:** The purpose of this study was to determine the effectiveness of a developmental reading program designed to improve reading abilities of eighth grade pupils in the Junior High School of Mexico, Missouri.

**METHOD OF RESEARCH:** The method of research employed in this study was the experimental method. The basic design involved an experimental population of 158 pupils in the eighth grade of the Mexico, Missouri, Junior High School and a control population of 166 pupils in the eighth grade of the Lee's Summit, Missouri, Junior High School. From these total populations matched groups of 124 pupils were established and compared on five areas of measured reading ability. The program was also evaluated by comparing boys with girls and a group of pupils in the upper segment of language intelligence with a group of pupils in the lower segment of language intelligence in the experimental population. A final comparison was made between the experimental and control populations in the amount of voluntary reading done.

**SUMMARY AND CONCLUSIONS:**

- (1) Both the experimental reading program and the control program were effective in producing significant gains in all areas of reading ability.
- (2) The experimental program was effective in producing reading growth significantly greater than that produced in the control program only in the speed of reading.
- (3) The experimental program was not effective in producing gains statistically superior to those produced in the control program in vocabulary, comprehension, and word attack skills.
- (4) The experimental program, as described in this study, was as effective in promoting reading growth among boys as among girls.
- (5) The experimental program resulted in no greater achievement among pupils in the upper segment of language intelligence than it did among pupils in the lower segment.
- (6) The experimental program was unusually effective in stimulating voluntary reading.

222 pages. \$2.90. Mic 56-3349

**THE EXPERIMENTAL TESTING OF A CONCEPT  
OF PERCEPTION WITH IMPLICATIONS  
FOR MUSIC EDUCATION**

(Publication No. 17,558)

Ted Warren Ward, Ed.D.  
The University of Florida, 1956

The major hypothesis of the study was that a series of experimental demonstrations in aural perception could be developed in order to illustrate a functional concept of perception. Experimental procedures were designed to test five minor hypotheses derived from an assumed concept of perception.

That individual differences in aural perception can result from a common stimulus in the environment was demonstrated in an experiment with sound-cage testing of localization acuity. The results of the experiment indicated that not all persons perceive the objective factors in a situation with the same degree of acuity and that environmental influences have significantly different effects upon various people's perceptions.

That aural perception originates within the hearer rather than within the object in the environment was indicated in an experiment with unidentified sounds. The subjects were asked to tell the meanings which they perceived for each of a pair of electronically-produced sounds (not recordings). It was concluded that the attaching of meaning to a sound is a subjective phenomenon, based partly upon conscious factors of association from the hearer's experience and partly upon subconscious factors which are not identified by the hearer.

That physiological differences cause differences in aural perception was illustrated in an experiment with threshold of hearing of high-frequency sound. It was concluded that the threshold differences among the subjects tested would make differences in their perceptions of tone quality.

That structured common experiences may not result in common aural perceptions was proved through an experiment with suggested programs for an unfamiliar musical composition. There was a tendency for the suggestion to reorient the perceptions of the experimental group in an unwholesome way. The suggestion seemed to make an otherwise unacceptable meaning of the music seem more acceptable, although it did not cause the group to increase significantly in their accepting of the suggested program.

That intellectual activities can be a hindrance to aural perception was shown in an experiment with a written task during a musical listening session. An experimental group was asked to take notes on the instruments heard in a particular musical recording. The control group, which had not been assigned a written task, made higher scores on a test related to the perception of instrumentation in the music. The students who had been asked to listen without making written notes were, on the whole, more perceptive than those who had been making notes.

The implications of the assumed concept of perception for the teaching of music were derived from the nature of aural perception and from the issues tested by the five experiments of the study. It was concluded that the music teacher must be accepting of students' values and ideas and must understand something of the role of perception in relation to music appreciation.

The experiments in the study indicated that to produce

modification of perceptions it would be necessary to consider both the experiences and the purposes of students. The music education learning situation should be based upon the provision of new experiences with music plus an accompanying purpose toward change on the part of the students. The purpose in musical listening experiences should come from the intrinsic motivation of a desire for a richer perception of beauty, art, form, and aesthetic satisfaction in music.

The organization of materials for teaching music appreciation must provide wider experiences and enable the student to make his own value judgments and decisions through his enriched perceptions. Values come through perceptions; thus, values and taste in music are a product of the individual's experiences and purposes.

156 pages. \$2.05. Mic 56-3350

**A GROUP APPROACH TO THE TEACHING  
OF READING TO COLLEGE FRESHMEN IN  
REMEDIAL ENGLISH CLASSES AT THE  
UNIVERSITY OF MISSOURI**

(Publication No. 17,910)

Arnold Henry Zaeske, Ed.D.  
University of Missouri, 1956

Major Adviser: A. Sterl Artley

**Purpose:** The purpose of this study was to determine the changes, if any, resulting from a group program designed to improve the reading abilities of freshman remedial English students at the University of Missouri in selected areas of reading achievement and English usage when instruction was given as an integral part of the course under the direction of English instructors.

**Method of Research:** The research method used in this study was the experimental method. The basic design of the experiment was to measure the effectiveness of a group reading program taught as an integral part of the remedial English course at the University of Missouri by comparing the results made by an experimental group and a control group on objective measuring instruments. The effectiveness of this program was determined in six areas; vocabulary, speed of comprehension, level of comprehension, the ability to identify the sounds of vowels and consonants, the ability to divide words into syllables, and English usage. The analysis of covariance technique was used as a means of matching the groups statistically and of determining the significant differences, if any, between the experimental and control groups.

**Conclusions:**

- (1) Regardless of whether the students enrolled in remedial English were subjected to either the reading program as described in this study or to the English program as regularly organized, they remained deficient in reading achievement at the end of one semester of college work. Their relative standing in reading achievement was little changed regardless of the nature of the two programs.

- (2) The experimental reading program was no more effective in improving the vocabulary, speed of comprehension, level of comprehension, ability to divide words into syllables, and English usage of freshman remedial English students than the regularly organized remedial course as taught by the control instructors.
- (3) The experimental reading program was more effective in improving the ability of freshman remedial English students to identify the sounds of vowels and consonants than the regularly organized remedial course as taught by the control instructors.

**Implications:** The experimental reading program, as described in this study, did not produce results of

practical significance in improving and refining the ability of students in the remedial English course. Possibly it is too much to expect improvement of practical significance from a reading program which is limited to one semester of time, which is dealing with low ability students, which is concerned with a group approach, and which is taught by instructors lacking professional training in the teaching of reading. Therefore, the writer suggests that remedial English students be subjected to a more concentrated reading program which takes into account individual needs and which is taught by an instructor professionally trained in the field of college reading.

244 pages. \$3.15. Mic 56-3351

## ENGINEERING

### ENGINEERING, GENERAL

#### THE RATIONALIZATION OF INDUSTRIAL DECISION PROCESSES (Publication No. 18,812)

William Thomas Morris, Ph.D.  
The Ohio State University, 1956

The study is an exploration of the foundations of the processes by which decisions are made within the context of engineering systems. It is directed toward the enrichment of the normative rules which are available for decision-making by engineers, managers, and military commanders. A principle is proposed, called the Axiom of Long Run Success, which states that the best decision rules are those which succeed in the long run. Rationality in the engineering problem is defined as making decisions in a manner which agrees with this principle. A solution to the engineering problem is taken to be a method of accomplishing this end.

A method for achieving rationality is discussed which is called rationalization. This method requires that the process of decision-making be made explicit, that it be logically consistent, and that it be logically truthful. The implications of this method are then explored. The status of Engineering Economy is discussed in the light of these considerations.

The three chief problems associated with value measurement in industrial systems are those of conflicting goals, the dynamic nature of goals, and the failure to achieve explicit goal statements. It is shown that the concept of state values may be taken as the appropriate concept of value for industrial systems. State value is defined as the expected values of future states to which the system may pass, and the relations between state values are explored. It is shown that in decisions in the face of risk where more than two outcomes are possible, an interval scale is required for value measurement. The method of Indifference Curves for expressing ordinal preference fields is discussed. The usefulness of the von Neumann utility measurement method, yielding an interval scale from preference statements about probability combinations of states, is pointed out.

Some of the basic theorems of probability theory are interpreted in terms of their implications for normative decision-making. The most important result is the demonstration of agreement between the Axiom of Long Run Success and the principle of choosing so as to maximize the expected value of the outcome. As an example, a class of decision problems in which only two outcomes are possible is presented.

Decision situations are structured in terms of outcomes, states of the world, and alternatives. The probability distribution of the states of the world and the values of outcomes are needed to provide complete information. The possibilities of developing methods of choice for various stages of incomplete information by the method of rationalization are explored. Methods of transforming a

decision situation from one stage of information completeness to another are presented. One of these methods is a sequential process in which the decision-maker stops after each increment in information and determines whether it is rational to choose or to collect more information.

The problem of judgment in engineering decisions is approached from the viewpoint of minimizing their use to achieve logical truth and of improving them where they must be used. A simple scheme for reducing the amount of discrimination required in making judgments is given. The topic of the combination of errors is employed to give rules for making compound judgments of various sorts. A theory of the timing of decisions is constructed.

200 pages. \$2.60. Mic 56-3352

### ENGINEERING, AERONAUTICAL

#### ON DETACHED SHOCK WAVES

(Publication No. 18,864)  
Donald Hoyt Novak, Ph.D.  
Purdue University, 1956

Major Professor: Merrill E. Shanks

The detached shock wave problem, as formulated in a distorted hodograph plane by F. Frankl, is a complicated boundary value problem for a mixed elliptic-hyperbolic partial differential equation. The classical approaches of Tricomi, Gellerstedt, and others to simple boundary value problems for canonical mixed equations seemed to hold promise in the detached shock application. Therefore in this thesis, attempts were made to modify and extend these approaches to include this more general problem.

Because the coefficients of the differential equation are not given explicitly in the distorted hodograph plane, an elementary solution to the equation in the elliptic half-plane could not be found. The existence of this elementary solution was assumed, however, and a generalized potential theory was written down by analogy with the work of Gellerstedt. In the course of this task, the so-called "hedgehog condition" along the shock polar was examined; and an integro-differential equation was obtained for the boundary values here. The prescription of these values is tantamount to solving the problem, hence the demonstration of a solution to this equation would amount to an existence proof for the detached shock problem.

Since the attempt to solve the problem in the distorted hodograph plane was thwarted by the implicit nature of the problem statement here, it was decided to examine the uncorrupted hodograph of the flow. It soon appeared that there was no advantage to be gained; for, although explicit coefficients could be obtained, the expressions became so cumbersome as to discourage further analysis. A careful

investigation of the hedgehog condition, however, revealed that some of the spines were ingrown, and that the point of tangency occurred where the shock wave was simultaneously tangent to a characteristic. It was argued then that this characteristic must be a fold in the hodograph plane, and that the Jacobian of the transformation from the physical to the hodograph plane,

$$j = u_x v_y - u_y v_x = 0 ,$$

along the "transition Mach Line" -- the physical image of the fold. Since the hodograph properties of transition, exceptional, and nonexceptional curves preclude the location of the terminal point of the shoulder image anywhere but on the fold itself, an inconsistency in the hodograph of the flow was demonstrated. It was not possible to construct a consistent hodograph for a physically reasonable flow.

Next the possibility of other coordinate transformations was considered. The hedgehog condition was extended mathematically to the complete family of shock polars -- including those with no physical meaning outside the limiting polar. The direction field thus obtained defined the "hedgehog streamlines." The streamline pattern in the neighborhood of the symmetry line looked like the expected hodograph of the flow against a bluff body, hence it was used to calculate the ratio of the shock detachment distance to the shock nose curvature.

Finally the concept of the 'vorticity function,'  $\phi$ , and its associated rotational flow potential were introduced; and, analogous to the case of irrotational flow, the rotational hodograph equations were derived. From the latter, it was possible to obtain the 'rotational Chaplygin equation' and the rotational hedgehog condition. Instead of resolving the question of existence and uniqueness of solutions to the detached shock problem, the introduction of  $\phi$  further complicated it by adding another dependent variable to be determined. However it did make possible a more rigorous formulation of the problem in that the irrotationality restriction could be relaxed. Assuming existence and uniqueness of the irrotational problem, an iteration procedure for solving the rotational flow was outlined.

128 pages. \$1.70. Mic 56-3353

functional form for the formulation of excess free energy of mixtures as advanced by Redlich and Kister. A step-wise procedure is followed in arriving at the expressions for binary systems. Corresponding expressions for the ternary systems are obtained by analogy with those for the binary systems.

Experimental observations of this study under a constant total pressure of one atmosphere are well correlated with the relationships thus developed. The more rigorous isobaric relationships lead to the same correlated equilibrium compositions as the conventional procedure; but they lead to improved correlation of equilibrium temperature for both the binary systems and the ternary system when the boiling range is considerable.

The system ethyl acetate-benzene shows the least deviation from ideality, and requires only a one-constant expression for correlation. The other two binary systems show larger deviation from ideality and each requires a two-constant expression for correlation.

The equilibrium conditions of the ternary system are well correlated with those of the binary systems. No characteristic ternary effect is observed, and no ternary constant is required for correlation.

The azeotropic compositions and temperatures of the binary systems benzene-cyclohexane and cyclohexane-ethyl acetate are determined. Azeotropism is found to be absent in the binary system ethyl acetate-benzene. No ternary azeotrope is found for the ternary system.

An equilibrium still is made to incorporate the desirable features of the Jones still and the Gillespie still. It may be considered as a variation of the vaporrecirculation stills.

Analysis of the mixtures is performed by measuring refractive indices and specific gravities of the mixtures. The composition is then read directly from calibration charts. The precision of analysis is  $\pm 0.1$  mole per cent for the binary mixtures and  $\pm 0.2$  mole per cent for the ternary mixtures. 169 pages. \$2.25. Mic 56-3354

## ENGINEERING, CHEMICAL

### VAPOR-LIQUID EQUILIBRIA IN THE TERNARY SYSTEM ETHYL ACETATE-BENZENE-CYCLOHEXANE

(Publication No. 19,076)

Kwang-Chu Chao, Ph.D.  
The University of Wisconsin, 1956

Supervisor: O. A. Hougen

A set of consistent relationships is developed for the description and correlation of the non-ideality of boiling non-electrolyte liquid solutions subject to the condition of restraint of the same total pressure over the entire composition range. The treatment is confined to binary and ternary systems. The development is based on the same

## AN INVESTIGATION OF THE FLOW PROPERTIES OF PSEUDOPLASTIC LIQUIDS

(Publication No. 19,156)

John Adolph Glass, Ph.D.  
Cornell University, 1956

Solutions of three polymers (polyisobutylene, polystyrene, and polymethylmethacrylate) in good and poor solvents were investigated in capillary viscometers and in a rotational viscometer for degree of pseudoplasticity and thixotropy. A solution of polyisobutylene (viscosity average molecular weight approximately  $2 \times 10^6$ ) in methyl cyclohexane was found to have a degree of pseudoplasticity of 23 at a concentration of 0.03 grams per cc. of solution.

The existence of a "wall effect" for flow of polyisobutylene-methyl cyclohexane solutions in tubes and capillaries was investigated. Consistency curves obtained in capillaries of diameter 0.0379 and 0.0596 cm. were identical to those obtained in flow tubes of diameter 0.312 and 0.648 cm. within the accuracy of the data ( $\pm 2\%$ ). The range of degree of pseudoplasticity of the solutions used was 6 to 23 and the overall range of rate of shear in the overlap region was 300 to 10,000 sec.<sup>-1</sup>.

Rotational viscometer consistency curves based on Mooney's average radius (radius yielding arithmetic average shear stress) were obtained on solutions of polyisobutylene in methyl cyclohexane and solutions of polymethylmethacrylate in chlorobenzene. For each solution separate curves were obtained for three bobs of diameter clearance 0.047 inches, 0.100 inches and 0.150 inches.

An end effect correction was developed for use of the viscometer on highly pseudoplastic solutions by modifying a correction due to Mooney.

Consistency curves obtained with the bob of smallest clearance were within experimental error ( $\pm 1\%$ ) with curves obtained from capillary data (based on the Rabinowitsch equation for rate of shear) for an overlap region of approximately 3,000 sec.<sup>-1</sup>. Curves for polyisobutylene in methyl cyclohexane compared with flow tube data with the same accuracy.

Consistency curves obtained on the bobs of greater clearance fell below the capillary and tube curves by 5 to 11 percent.

Limited data indicated that turbulence occurred in the rotational viscometer at an apparent viscosity 1.3 to 1.4 times the viscosity predicted for turbulence of Newtonian fluids.

317 pages. \$4.10. Mic 56-3355

#### HEAT TRANSFER IN LAMINAR FLOW

(Publication No. 18,851)

Joseph Francis Gross, Ph.D.  
Purdue University, 1956

Major Professor: H. C. Van Ness

The present investigation was concerned with the experimental and mathematical determination of local heat-transfer rates from vertical tubes to fluids flowing upward in them in fully-developed laminar flow. Three tubes sizes, (1/4", 3/8" and 1/2" diameter) were used with three fluids (water, 50% aqueous ethylene glycol, and ethylene glycol). It was desired to obtain an empirical correlation and a mathematical expression representing the heat transfer occurring in this system.

The measurements were made in a vertical tube 13 feet high. The upper 8 feet consisted of an electrically-heated test section in which the fluid was heated. Thermocouples placed at one-foot intervals measured the temperature profile along the test-section tube-wall and a mixing cup at the top of the test section measured the leaving bulk temperature of the fluid. The procedure in making a run consisted in adjusting the flow rate through the test section until the desired value was obtained. The current was regulated until the required bulk temperature rise through the test-section was obtained. The thermocouple readings along the tube wall were taken. A method was developed for calculating the temperature gradient in the fluid at the wall ( $dt/dr$ )<sub>w</sub> for any location along the test section.

The data were correlated with a linear multiple regression analysis employing the method of least squares to give the dimensional equation:

$$(dt/dr)_w = 68 (N_{Re})^{0.16} (D)^{-0.36} (\Delta t)$$

where  $(dt/dr)_w$  = temperature gradient in the fluid at the tube-wall of  $^{\circ}\text{F}/\text{ft}$ .

D = inside diameter of the tube in inches

$\Delta t$  = difference between the inside-tube-wall temperature and the bulk temperature of the fluid in  $^{\circ}\text{F}$ .

The data fitted this equation to within 20%.

The mathematical analysis of the problem, as outlined in the Theory section, resulted in the following equation:

$$\begin{aligned} T = a_0 + \frac{za_0}{4} y^2 + & \left( -\frac{za_0}{16} + \frac{z^2 Ja_0}{64} \right. \\ & + \frac{z^3 J(J-1)}{512} a_0^{3J-2} \Big) y^4 + \left( -\frac{5Jz^2 a_0}{576} \right. \\ & - \frac{z^3 J^2 a_0^{3J-2}}{2304} + \frac{z^4 J^2 (J-1)}{18,342} a_0^{4J-3} \Big) y^6 \\ & + \left( -\frac{5z^2 J^2 a_0^{3J-2}}{36,864} + \frac{3z^4 J^2 (J-1)a_0^{4J-3}}{32,768} \right. \\ & - \frac{z^4 J^2 (J-1)a_0^{4J-3}}{147,456} - \frac{Jz^2 a_0^{2J-1}}{1024} \\ & \left. + \frac{z^5 J^2 (J-1)^2 a_0^{5J-4}}{117,965} \right) y^8 \end{aligned} \quad (35)$$

It was found that this equation predicted experimental  $(dt/dr)_w$  values to within 30% and when integrated gave the mixing-cup temperature to within  $5^{\circ}$ .

169 pages. \$2.25. Mic 56-3356

#### CATALYTIC HYDROGENATION OF ALPHA-METHYLSTYRENE IN LIQUID PHASE IN STIRRED REACTOR

(Publication No. 17,317)

Douglas Lewellyn Johnson, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Olaf A. Hougen

This thesis provides a study of experimental data on the rate of hydrogenation of liquid alpha-methylstyrene to form isopropyl benzene with suspended palladium catalyst in a stirred reactor under batchwise operation.

Operating variables covered the following ranges: temperature, 60 to  $100^{\circ}\text{F}$ ; pressure, 10 to 150 lbs. per sq. in. gage; stirring rate, 135 to 790 rpm; rate of flow of hydrogen at outlet, 1 to 116 cu. ft. per hr. measured at  $32^{\circ}\text{F}$ . and 1 atm.; superficial hydrogen velocity based on inside diameter of reactor, 0.06 to 3.35 ft. per min. Catalyst loading was held constant at 2.500 gm. per 2500 gm. of liquid, equivalent to 0.002% palladium.

The reactor, of one gallon capacity, was fitted with baffles, gas sparger, cooling coils, flat-blade impeller, sampling tube, and external electric heaters.

Under the stated operating conditions, the rate of hydrogenation was limited by the rate of transfer of hydrogen from the gas phase to the surface of the catalyst, and chemical resistance to the reaction rate was negligible.

The following equation relates overall mass transfer coefficient to the operating variables with an average error of 12.6%.

$$\frac{K_0 D^2 \rho}{\mathfrak{D}} = K \left( \frac{D^2 N \rho}{\mu} \right)^x \left( \frac{DN}{V_s} \right)^y \left( \frac{\mu}{\rho \mathfrak{D}} \right)^{0.5}$$

where:  $K_0$  = overall mass transfer coefficient of hydrogen, lb. mole/(min)(lb. catalyst)(lb. mole hydrogen/cu. ft. of gas).  
 $D$  = diameter of impeller, ft.  
 $\rho$  = density of liquid, lb./cu. ft.  
 $\mathfrak{D}$  = diffusivity of hydrogen through liquid, sq. ft./min.  
 $K$  = proportionality constant, varies with the Reynolds number.  
 $N$  = stirring rate, revolutions/min.  
 $\mu$  = viscosity of liquid, lb./(ft.)(min.).  
 $x$  = exponent of Reynolds number  
 $192.4(\text{Re. No.})^{-0.441}$   
 $V_s$  = inlet superficial gas velocity based on inside diameter of reactor and temperature and pressure of reaction, ft./min.  
 $y$  = exponent of the gas flow number, equal to -0.6. For values of gas flow number on or below the transition point curve, Figure 33, which shows the point at which further increases in gas flow number will not increase overall mass transfer coefficient, the value of the gas flow number is constant and equal to the value at the transition point.

244 pages. \$3.15. Mic 56-3357

#### HEAT AND MASS TRANSFER IN FREEZE DRYING

(Publication No. 19,106)

John Boyd Lambert, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William Robert Marshall, Jr.

A radiant-heated, pilot, freeze dryer containing a sample tray one-half square foot in area and proximal to a flat plate, refrigerated condenser was used to study the effect of the operating variables on the rate and temperature level at which drying occurs. These variables were the rate of energy input, vacuum, condenser temperature, tray loading, and nature of the frozen material being dried. In the processing of whole milk, baker's yeast, and a bacterial suspension, the effect of freezing and drying conditions on product quality was considered.

A theoretical analysis yielded coupled expressions describing the rate of freeze drying from both heat and mass transfer viewpoints. In each approach, an equation of the form,

$$\text{Drying Rate} = \frac{\text{Driving Force}}{\sum \text{Resistances}}$$

was obtained. For mass transfer, the resistances included those at the subliming and condensing interfaces, through the partially-dried, porous solid, and between the sample and condenser.

For water-ice sublimation, good agreement with theory was obtained. In these studies, rates of sublimation were varied from 0.50 to 1.50 pounds per square foot-hour over a range of absolute total pressure of 185 to 2150 microns. In all cases, the water vapor pressure at the subliming interface was very nearly equal to the total pressure. The latter is in agreement with the theoretical prediction that the interfacial mass transfer resistance is usually not important in freeze drying above 150 microns total pressure. These experiments also indicated that diffusion of water vapor was the most important mechanism for mass transfer to the condenser although bulk flow under a pressure gradient probably occurred to a lesser degree. A nomograph useful for preliminary estimations of freeze-drying rates and based on the diffusion mechanism was prepared.

For the freeze drying of materials containing solids, the mass transfer resistance afforded by the cake layer above the zone of sublimation was important. Because of the structural variation of this layer with drying time, it was not possible to correlate this resistance with material properties. The chief variables affecting the rate of drying were the energy input and tray loading while the drying temperature level was influenced primarily by the total pressure, condenser temperature, and the structure of the dry cake layer.

In drying of slabs, both constant and falling-rate periods of drying were normally encountered. Overall average drying rates were in the range 0.01 to 0.30 pounds per square foot-hour. For freeze drying of beds of frozen pellets, drying rates were less at loadings comparable to those for slabs.

In measuring product quality of milk and the percent viable recoveries of baker's yeast and bacterial suspensions after freeze drying, several observations were made. Considerable breakdown of the fat emulsion was noted upon reconstituting freeze-dried whole milk. The emulsion stability appeared to increase with decreasing freezing rate for constant drying conditions. Slow drying gave the best milk quality. Very fast freezing was detrimental to baker's yeast, and the better survivals were obtained by slow drying. In drying of the bacterial suspensions, the nature of the suspending media was the most critical factor. Rates of freezing and drying were of little significance.

279 pages. \$3.60. Mic 56-3358

#### OXIDATION-REDUCTION PHENOMENA IN THE FERMENTATION OF STREPTOMYCES GRISEUS

(Publication No. 17,096)

Siegfried Shlomo Lichtblau, Ph.D.  
Columbia University, 1954

A method was devised to evaluate reproducible and interpretable indices for a microbiological propagation, which are based on oxidation-reduction (redox) potential data. Streptomyces griseus (Waksman strain #4) was chosen as test organism for several reasons. One is the general industrial significance of microorganisms of this

type, which produce materials of economic value. Another reason is, that its metabolic activity can be conveniently traced over a reasonable time spread making possible an eventual correlation with redox-indices. The method is based on tracing potentiometrically the reduction of a dye of suitable amount and concentration by a definite volume of cell suspension, with the pH constant.

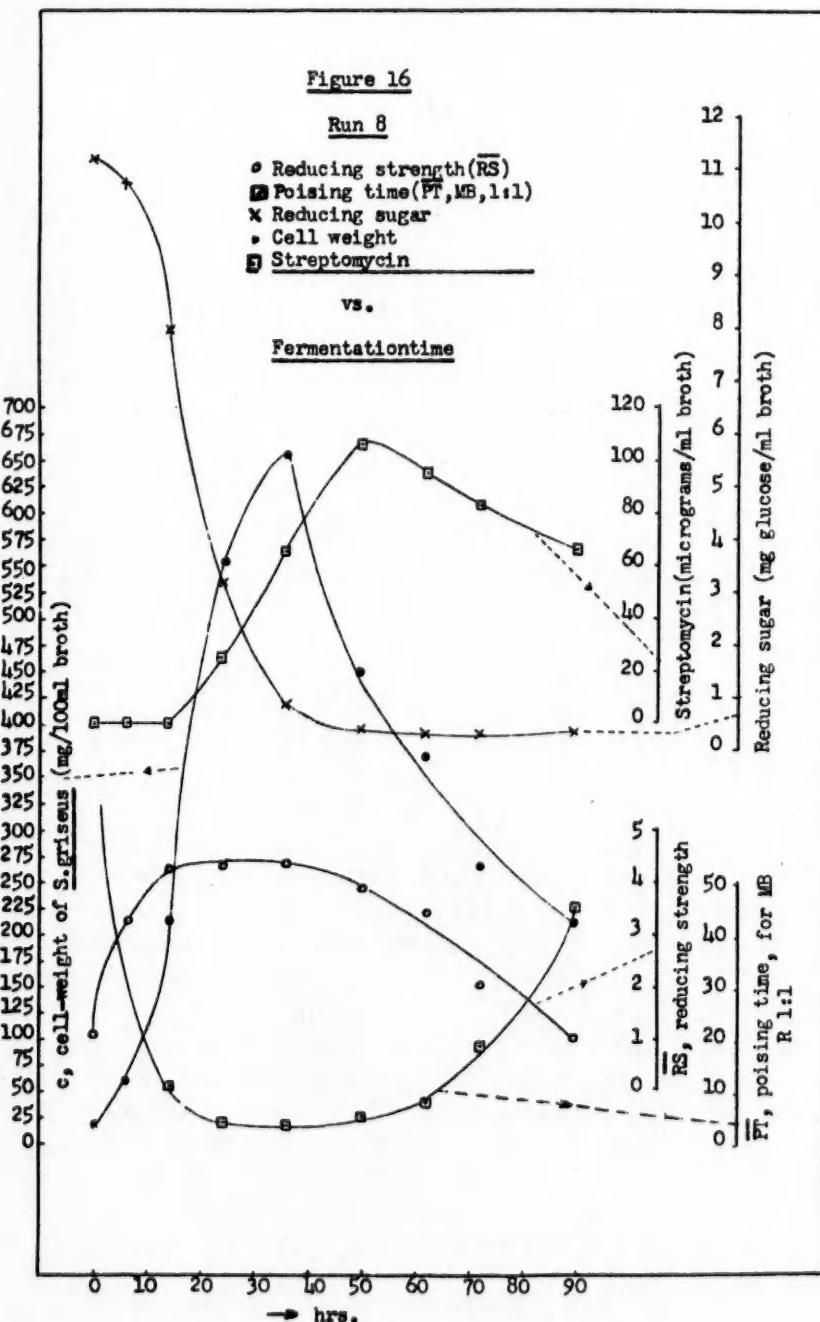
One index is based on the time it takes the suspension to reduce the dye between the limits of its poised region and is called poising-time (PT). The poised region of the dye is defined as the zone of potential where under specified conditions potentials measured with at least 2 suitable noble metal electrodes are identical, while beyond its limit they are not. For a buffer concentration of 16ml/100ml dye-suspension mixture (buffer: 1 M  $\text{KH}_2\text{PO}_4$ , 62.5 vol.% 1 M NaOH 32.5 vol.%) which will maintain a constant pH of 7 during the entire measurement and a concentration of methylene-blue of  $1.0 \times 10^{-3}$  M the lower limit is  $E_{sc}$  220mV and the upper limit  $E_{sc}$  268-270mV.  $E_{sc}$  is the potential with reference to the saturated calomel electrode. For a PT value to be correct it has to be inversely proportional to the volume of cell suspension at a certain age. PT can also be used as an indication of the amount of cells present at a certain age, since it is

inversely proportional to cell-weight. This is of importance for filamentous organisms which have no distinct individual cells which can be counted under the microscope. The other index is based on PT and on the amount of cells which are the source of reducing activity and is called reducing strength (RS). RS is defined as  $\frac{10000}{c \cdot PT}$ , where  $c$ : cell weight (mg/100ml) and  $PT$ : poising time for  $c$ , reducing an arbitrarily chosen amount of dye of a specific concentration. Since RS brings the motivating factor of the reduction quantitatively into account, it puts the correlation of reducing activity with other factors of a propagation on a sounder basis than PT alone. Accordingly S. griseus exhibits its maximum reducing strength from about 14-36 hrs. A graph showing the correlation between reducing strength and poising time with concentration of streptomycin, reducing sugar and cell weight is given. Streptomycin production starts at the time when reducing strength reaches its peak but is at its own maximum at about 50 hrs. when RS has declined already. Cell weight increases at the maximum rate when RS reaches the peak and reaches its maximum when RS leaves the peak. Consumption of reducing sugar is at its maximum at the initial peak point of RS and its concentration reaches the minimum at the final peak point. RS is therefore a good indicator of general metabolic activity.

Data of potentials taken on cell suspensions without addition of another redox system do not enable one to draw unequivocal conclusions as to reducing activity although they make an educated guess possible. With unpoised systems absolute values of potentials seem to depend as much on the characteristics of the individual electrode as on the weak intermediate or irreversible systems in contact with the former. It was however noticed that potential-time data in unposed runs follow straight lines on log-log plots most of the time of measurement.

Experiments with other organisms and other dyes will have to be carried out to verify the significance of the absolute values of the established indices PT and RS.

136 pages. \$1.50. Mic 56-3359



#### SEPARATION PROCESSES USING PERMSELECTIVE MEMBRANES

(Publication No. 19,119)

Karl-Axel Melkersson, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Charles C. Watson

Permselective membranes are membranes of ion exchange type which possess a low resistance to electrical current and effectively prevent the transfer of either cations or anions across the membrane when the electrical current passes through it. For design purpose an understanding of the general physico-chemical behavior of these membranes and the relations between different transfer phenomena is vital.

A general discussion of the equilibrium behavior of these membranes is given in this thesis. General phenomenological equations are derived for the isothermal transfer phenomena using the principles of the

thermodynamics of irreversible processes. The equations include the effects of chemical potential, electrical potential, and static pressure differences across the membranes. The great value of the equations is that they correctly describe any processes in which electricity and matter are transferred across any type of membrane. However, in spite of relating the different transfer characteristics in an irrefutable manner the equations do not predict the size of these characteristics and do not explain the causes of the transfer effects in terms of the properties of the membranes.

From the phenomenological equations it is concluded, that the transfer of non-ionic species must always be considered and that in spite of having no charges the non-ionic species will always exert an influence upon all the electrical characteristics of these processes.

The transference numbers, which characterize the effectiveness of the blocking of the passage of either cations or anions, have in the past been estimated from measured membrane potentials without considering the transfer of water. However, in this study it has been emphasized that these transference numbers are apparent transference numbers, which deviate considerably from the true transference numbers particularly in concentrated solutions. The deviations will be largest for polyvalent ions.

Instead of characterizing the membranes by these vague apparent transference numbers it is recommended that permselective membranes are characterized by the true transference numbers of cations, anions, and water. The true transference numbers of the ions are suggested to be calculated from measured values of the membrane potentials, when the chemical potential of water is made the same in both the external solutions by applying a static pressure to the concentrated solution. Using these transference numbers, the transference numbers of the water is then estimated from the value of the membrane potential when no static pressure difference exists between the external solutions.

The water transfer across a pair of Amberplex membranes was experimentally determined for sodium chloride solutions of various concentrations. At a current density of 3 milliamperes/square centimeter the electro-osmotic water transfer increased with decreasing concentration from a value of 195 cubic centimeter/Faraday in 1.35N solutions to a value of approximately 300 cubic centimeter/Faraday in very dilute solutions. It is concluded that using these membranes, 15 to 17 per cent of the original water will be lost due to electro-osmotic transfer, when 35000 p.p.m. sodium chloride solutions are purified to 500 p.p.m. by electrodialysts, but that the water losses will be minor when solutions having 2000 to 4000 p.p.m. original concentration are desalinated.

The production of electric power using multiple cells as indirect solar engines has been considered. It is concluded that such a process is not economically feasible for the present.

The economical prospects of the demineralization of saline solutions in a combination cell have been investigated. The combination cell is based upon the principle of the all-electrolyte electrical circuit. When the osmotic energy of one multiple cell degrades, part of this energy is used for the purification of saline solutions in a second multiple cell, which is coupled in series with the first cell through electrolyte bridges. The process does not seem

to be economically feasible until the present membrane costs are substantially reduced.

180 pages. \$2.35. Mic 56-3360

#### INVESTIGATION OF THE ACTIVATION ENERGY FOR DIFFUSION OF Xe<sup>133</sup> THROUGH MgO-Ni CERMET COMPACTS

(Publication No. 18,000)

Willis Elvis Moody, Jr., Ph.D.  
North Carolina State College, 1956

Supervisors: Drs. W. D. Whitehead, W. W. Kriegel

The diffusion of fission products through solids is of great importance in the design and construction of nuclear power reactors. Xe<sup>133</sup> is one of the principal radioactive fission products. The Xe<sup>133</sup> was produced by irradiation of UO<sub>2</sub> in a nuclear reactor. The UO<sub>2</sub> formed the central or core portion of small disks made from a 66% Ni and 34% MgO cermet material. A gamma-ray spectrometer was used to make determinations of the amounts of Xe<sup>133</sup>.

Diffusion rates were determined in the temperature range of 800° C. to 1100° C. The activation energy for diffusion was determined to be 4.4 ev. with the diffusion coefficient given by the equation:

$$D = 1.85 \times 10^7 e^{-\frac{4.4 \text{ ev.}}{kT}}$$

The concentration of Xe<sup>133</sup> for this investigation was fixed at an extremely small amount, approximately 10<sup>12</sup> atoms. The mechanism of diffusion appeared to be of the atom and vacancy interchange type and probably occurring along grain boundaries. 70 pages. \$1.50. Mic 56-3361

#### VAPORIZATION OF SUPERHEATED DROPS IN LIQUIDS

(Publication No. 17,330)

George Richard Moore, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor W. R. Marshall, Jr.

A theoretical and experimental study of the vaporization of superheated liquid drops in free motion in an immiscible non-superheated liquid has been made. The results are expected to provide insight into the nature of the processes of bubble formation in boiling and cavitating liquids and in supersaturated solutions of gases.

Several attempts to calculate and to measure the extreme conditions of temperature and pressure under which a liquid in a metastable condition becomes unstable with respect to vapor formation have been reported in the literature. Satisfactory agreement of theory with experiment has not been obtained, partially because bubble formation in the metastable liquids was affected by solid surfaces, ionizing radiation, or other external influences. Such

effects were minimized in the present work by dispersing the superheated liquid into drops.

The presently available theories of bubble formation in liquids were examined. The theory of Döring was modified, with non-ideal behavior of the vapor taken into account. The special significance attributed to bubbles containing zero molecules was eliminated from the theory. Döring's theory was extended to apply to superheated drops immersed in another liquid, under the assumptions that the liquids were totally immiscible and that their vapors which were treated as non-ideal formed an ideal solution.

In the experimental work, drops of purified Freon-12 (dichlorodifluoromethane) were sprayed into distilled water in a pressure cell. The pressure was measured at which drops 0.1 to 0.3 millimeters in diameter vaporized on reducing pressure at constant temperature. The vapor pressure of the liquid pair was obtained by measurement of the pressure required to cause slow condensation of vapor bubbles; the condensing range was two lb per sq in. Measurements were made at temperatures from 70°C to the critical temperature of the system,  $111.3 \pm 0.2^\circ\text{C}$ . The maximum error in the temperature measurements was  $0.2^\circ\text{C}$ ; in the pressure measurements, two lb per sq in. The interfacial tension between water and liquid Freon-12 was measured to be 24 dynes/cm at  $76.6^\circ\text{C}$  and 27 dynes/cm at  $104^\circ\text{C}$ .

Vaporization pressures for Freon-12 drops in water were calculated from the results of the theoretical development. The surface tension of Freon-12, necessary in the calculation, was obtained from values at  $0^\circ\text{C}$  and  $30^\circ\text{C}$  reported by Plank, by extrapolation to temperatures up to the critical point. The calculated vaporization pressures were found to agree with the experimental within the errors of measurement over the range of pressures investigated, from two atmospheres to the critical pressure. A variation of  $\pm 3\%$  in the surface tension of Freon-12 was allowed because of possible error in the extrapolation and because of the possible effect of water dissolved in the Freon-12. The vaporization pressures obtained by Wismar in experiments on ethyl ether in glass capillary tubes were compared with pressures calculated from the theory and found to agree at atmospheric pressure but not at elevated pressures. The discrepancies were ascribed to experimental errors.

It is concluded that the theory of Döring describes correctly the processes which take place in the formation of bubbles in superheated liquids in the absence of external influences. In addition, the assumptions made in the calculation of numerical results from the theory are satisfactory for superheated organic liquids at atmospheric pressure and above. It is further concluded that the properties of superheated drops may make them useful in several other types of investigation, including measurements of turbulence, radioactivity, and the tensile strength of liquids.

217 pages. \$2.85. Mic 56-3362

## STUDIES IN MASS TRANSFER INVOLVING THE USE OF THE FREQUENCY RESPONSE TECHNIQUE

(Publication No. 18,822)

David Arthur Strang, Ph.D.  
The Ohio State University, 1956

As the amount of information available to chemical engineers expands and becomes more complex, the need for unifying concepts becomes more pressing. One such concept emerges from a consideration of the multitude of unit operations and processes as combinations of these basic areas: thermodynamics, fluid dynamics, heat transfer, mass transfer, and reaction kinetics. While these are listed as separate areas of study, the interactions among them are important and many times unknown. Frequently mass and heat transfer may be rate-limiting factors. Especially in a system in which material must diffuse through a liquid, either to or from a solid, the transfer mechanisms and their interrelationships are of considerable importance.

The frequency response technique offers a way of making simultaneous measurement of several mass transfer constants, and thus should eventually make possible the determination, not only of the magnitude of the constants, but also of the nature of the interactions among them. This experimental method, as presented, involves a study of the changes in a sinusoidal composition wave as a result of its passing through a packed bed of spheres. The transfer processes cause an amplitude decrease and a phase shift in the outlet wave, as compared with the inlet. Equations, similar to those previously derived for gases, are derived relating this amplitude change and phase shift, together with other physical factors of the system, to four coefficients: the longitudinal diffusivity, the adsorption coefficient, the diffusion constant for solids, and the liquid film transfer coefficient.

The longitudinal diffusivity,  $D_L$ , was determined from measurements made on a bed of glass beads with a solution of 2-naphthol.  $D_L$  was found to increase from 0.080 to 0.325 sq.cm./sec. as the liquid velocity changed from 0.55 to 1.56 cm./sec. In measurements on a packed bed of six mm. alumina spheres and with the same solution, values of 0.90 for the adsorption coefficient and 0.025 for the solid diffusion coefficient were obtained. The film coefficient,  $k_L$ , varied from 14.0 to 39.2 lb./(hr.)(sq.ft.) (lb./cu.ft.) as the modified Reynolds number changed from 15.5 to 41.0.

The values for longitudinal diffusivity compare well with other similar data. These values are about six to ten times higher than those reported for radial eddy diffusivities. The value for the solid diffusivity seems high, compared with molecular diffusivities in liquids ( $10^{-4}$  to  $10^{-5}$ ). Other workers obtained a similarly shaped plot for the liquid film coefficient, but with a Reynolds number range of 56 to 340 for the same  $k_L$  range. The fact that the film coefficient calculated by these authors was an over-all value, including the effect of longitudinal diffusivity, should explain part of the difference noted.

Specially designed pumps, driven by two cams which were coupled to a variable-speed, electric motor-driven gear chain, were used to generate the sine waves. Clear fused quartz tubing was used for the experimental column, and the waves were analyzed by using the ultraviolet

absorption property of the 2-naphthol in conjunction with a phototube and a sensitive recorder.

The results indicate that the frequency response technique has good potential as a means of measurement for mass transfer studies. There is still a question as to why the values for the solid diffusivity and film coefficients were higher than would be expected. It is anticipated that future refinements in the application of the frequency response technique will help answer this. The experimental equipment was quite satisfactory except for certain parts of the analytical apparatus, for which improvements were suggested.

129 pages. \$1.75. Mic 56-3363

#### A STUDY OF AIR FLOW AND PARTICLE MOTION IN A VORTEX SPRAY DRYER MODEL

(Publication No. 17,345)

William Raymond Thomas, Jr., Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William Robert Marshall, Jr.

This thesis was concerned with a study of the effects of certain design variables on the velocity gradients and pressure drop for air flowing in vortex motion through a Plexiglas spray dryer model. A preliminary investigation of the residence times of particles in the vortex flow system was also made. The type of vortex flow pattern studied was that which occurs in a cylindrical chamber having tangentially directed air inlets around the top periphery and a centrally located exit at the bottom. The research was undertaken to provide a sound basis for the study of spray-gas mixing in spray drying, and to make possible comparisons of vortex flow with other types of flows in spray dryers, as well as to allow intelligent design of the vortex dryer.

Tangential velocities were measured by means of a technique involving the measurement of the rate of rotation of a ball around a pivot centered on the vortex axis. The tangential velocity distribution was found to be similar to that which occurs in cyclone separators. The data were correlated with a modified form of the Navier-Stokes equations for laminar flow. An attempt was made to relate the superficial inlet velocity to the tangential velocity at the periphery of the vortex system. Downward axial flow was found to occur near the chamber walls and in a central core region of approximately the same diameter as the exit duct. There was a small upward flow in the annular space between these two regions. Inwardly directed radial velocities were measured from photographic observation of the cylindrical core structures developed by smoke introduced into the model dryer. These velocities were found to be 100 times smaller than the tangential velocities.

Pressure drop data were found to agree approximately with the theory proposed by Stairmand.

Particle residence times in the vortex system were determined with a photomultiplier-amplifier-recorder arrangement which detected dust by light reflection in the exit duct of the spray dryer model. Two different residence times were found to be possible for particles introduced centrally at the top of the model dryer, depending on

whether they were thrown by the centrifugal action of the vortex to the chamber walls and then carried out of the model in the axial wall flow, or whether they remained in the high axial velocities of the central core region to be carried very rapidly to the exit.

204 pages. \$2.65. Mic 56-3364

#### ENGINEERING, CIVIL

##### THE INFLUENCE OF RESIDUAL STRESS ON THE INSTABILITY OF COLUMNS

(Publication No. 19,363)

Alfons Wilhelm Huber, Ph.D.  
Lehigh University, 1956

The problem of the influence of residual stress on column strength is divided into two parts. First the formation and distribution of residual stresses in beams are studied and then their influence upon axially and eccentrically loaded columns is investigated.

General formulas for residual stresses in beams are developed for both linear and non-linear stress-strain relationships. The stresses in a plate during the cooling process are calculated and typical examples of cooling stresses are given for various cross-sections. The distribution of residual stresses near the ends, in particular the length from the free end to the section where the full value of stress is obtained, is derived from considerations of a plane stress problem. The effect of plastic deformations and partial relaxations is also studied.

The general theory of axially loaded columns with symmetrical residual stress patterns is developed and the effect of different variables is investigated. Axially and eccentrically loaded columns containing residual stress patterns with at least one axis of symmetry are treated by both exact and approximate methods.

In order to correlate the theoretical derivations with tests, residual stresses were measured in a number of beams and a number of axially loaded columns were tested. Experimental verification was thus established for the case of axially loaded columns.

The results of this study may be summarized as follows:

1. Residual stresses in columns are formed as a result of the permanent deformation of certain fibers during the cooling process, or due to plastic deformation during fabrication.
2. The magnitude and distribution of cooling residual stresses depend on shape, initial temperature, cooling conditions, and material properties.
3. Residual stresses in long columns and their deformations are determined by one fundamental equation and modifications thereof.
4. The magnitude of the influence of residual stresses upon column instability is found to depend on various factors:
  - (a) the distribution and magnitude of residual stress
  - (b) the loading condition (axial-eccentric)
  - (c) the shape of the section
  - (d) the axis of buckling
  - (e) the stress-strain relation of the material.

5. Axially loaded columns made of a material with a definite yield point (mild steel) show a reduction of strength due to residual stresses. However, columns whose total stresses do not exceed the yield point will be unaffected by the presence of residual stresses.

6. The straight-line column curve for the inelastic range of axially-loaded columns, as found empirically almost half a century ago by Tetmajer, has been justified for the first time theoretically by the consideration of residual stresses.

7. Columns of a material without a definite yield level, and with a continuously curving stress-strain diagram, show an influence of residual stress for the whole range of slenderness ratios. For such materials, and for certain residual stress distributions, a higher buckling strength can be achieved than in the absence of residual stresses.

8. The critical stresses for columns with equal end eccentricities and for axially loaded columns where residual stresses have only one axis of symmetry, can also be predicted. By this theory the secant solution is "unsafe" for  $ec/r^2 = 0.1$  and  $L/r > 60$ .

9. Since the exact solution of the eccentric column is very cumbersome an approximate method has been developed which permits the rapid calculation of critical stresses.

With the aid of the theory presented in this dissertation it is possible to solve both the axial and the eccentric column problem when residual stresses with one axis of symmetry are present in the member.

118 pages. \$1.50. Mic 56-3365

#### PLASTIC DESIGN OF MULTI-SPAN RIGID FRAMES

(Publication No. 19,364)

Robert Lewis Ketter, Ph.D.  
Lehigh University, 1956

Present day analysis and design of continuous structures as defined by specifications and design codes are based on an assumed elastic behavior of the structure. The criterion of the design in most cases is the attainment of an allowable extreme fiber stress. While a design that results from using such a procedure will be safe, the actual degree of safety is unknown and may vary between extreme limits.

During the past several years a different type of analysis based on the ultimate strength of a structure as a whole has been developed. This new procedure known as "plastic analysis" or "plastic design" gives a clearer insight into the actual strength behavior of structures and therefore promises a more economic usage of materials. It should also be noted that the procedure is rational and has proven to be extremely time saving.

After reviewing the basic assumptions of plastic analysis, this dissertation presents a method whereby complex multiple span frames can be readily designed. Curves which facilitate the solution are also presented and several examples are carried out. The problem of economy in main member is discussed and procedures are presented whereby the design of a "least weight" structure can be approached.

177 pages. \$2.35. Mic 56-3366

#### VORTEX FLOW FROM HORIZONTAL THIN-PLATE ORIFICES

(Publication No. 19,104)

Richard Clark Kolf, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor James R. Villemonte

Vortex flow can be useful and detrimental in the design of hydraulic structures and machines. Centrifugal pumps and turbines (turbo-machines) depend on vorticity for their operation. The peculiar characteristics of free spiral vortex flow from horizontal thin-plate orifices were utilized to advantage by Mr. J. C. Stevens, Consulting Engineer of Portland, Oregon, in the design of a side outlet control device for a combined sewerage system. The characteristics of vortex flow are not fully understood, and only scattered, uncorrelated information is available on the subject.

A research project was initiated in 1950 by Mr. Stevens at the University of Wisconsin, and financed in part by him, the Wisconsin Alumni Research Foundation and the Department of Civil Engineering.

A total of 373 test runs were made with water on orifices ranging in size from 2 in. to 8 in., with heads ranging from 0.1 to 2.7 ft. The orifices were mounted in two cylindrical tanks, 12 ft. and 6 ft. in diameter. Tests were made first with free radial approach conditions and later with vorticity induced by guide vanes concentric with the orifice opening. The ratio of boundary diameter,  $\frac{B}{D}$ , ranged from 100 to 4.

A dimensional analysis of the problem indicates that the discharge equation is of the form

$$Q = CA \sqrt{2gH}$$

where  $C = f''(\frac{B}{D}, N_R, N_V)$ , in which  $N_R$  is Reynolds

number and  $N_V = \frac{\Gamma}{VD}$  is a newly developed parameter defined here as the vortex number.  $N_V$  is equal to the ratio of the centrifugal and inertia forces and is the basis for dynamic similarity in cases where centrifugal forces predominate.

With free approach conditions the weak vortexes which were formed were found to have little effect on the standard value (0.60) of the orifice coefficient,  $C$ .

For large induced vortexes the equation

$$C = 0.686 - 0.218 N_V$$

rectifies all the data with an accuracy of 5 to 7 percent, provided the  $\frac{B}{D}$  or boundary effects are accounted for by a special extrapolation to obtain a hypothetical static head. The vortex strength as indicated by the circulation,  $\Gamma$ , or the vorticity factor,  $K$ , is computed from surface profile measurements taken at a point  $x = D$  from the orifice centerline. The above equation is valid for

$$0.394 < N_V < 3.14$$

Because of the small variation of Reynolds number in the tests, no effect of viscosity could be detected. It is recommended that future studies be made with more viscous fluids, in order to determine the effect of viscosity on the orifice coefficient. 106 pages. \$1.50. Mic 56-3367

**ENGINEERING, ELECTRICAL****A STUDY OF INCREMENTAL LOSSES  
IN ELECTRIC POWER TRANSMISSION SYSTEMS**  
(Publication No. 18,844)

Ahmed Hanafy El-Abiad, Ph.D.  
Purdue University, 1956

Major Professor: J. B. Ward

The principles of loading generating stations according to incremental rate characteristics have been known and practiced for a number of years. More recently the effect of transmission losses upon economy loading of plants has received attention. The continued rapid growth of transmission networks and system interconnections brings about increased interest and emphasis in the over-all problem of operating systems at optimum economy.

The analysis of conditions for achieving minimum operating cost in the parallel operation of several plants and where transmission losses must be considered seems to be particularly subject to difficulties in interpretation both of terminology and of mathematical expressions and derivations.

The first part of this thesis is a discussion of the problem of economy loading and the factors affecting it. A review of the practices, methods and limitations of these is given and an effort is made to evaluate and explain the physical meaning of the incremental delivered cost factor,  $\lambda$ .

A new method to determine the incremental transmission losses without the need for a loss formula is presented. It relies on the individual line incremental losses and the power distribution factors for incremental swing of power between two points in the system.

The results of the numerical studies, which were made with the help of the network analyzer and the modern high speed digital computer, seem to support both the feasibility and accuracy of the new method.

The new method for determining the incremental transmission losses for use in connection with economy loading could be applied either manually for smaller systems, or automatically for larger systems. An easy and cheap method is suggested for the manual economic dispatch and control of moderate size systems.

144 pages. \$1.90. Mic 56-3369

**THE EFFECT OF CATHODE TEMPERATURE  
ON SPACE CHARGE LIMITED CURRENTS  
IN HIGH VACUUM TUBES**

(Publication No. 18,846)

Robert Neil Faiman, Ph.D.  
Purdue University, 1956

Major Professor: John M. Cage

The electron tubes used in direct coupled amplifier circuits introduce drift voltages in the output which cannot be completely eliminated by conventional stabilization techniques such as the use of regulated power supply

voltages, compensated circuit components, push-pull circuits, or feedback. The usual approximate engineering analysis procedure for electron tube behavior does not yield satisfactory results when applied to the problem of drift in tube characteristics, where such drift is a function of cathode temperature change.

This research is a return to the basic relationships involving space charge limited current, tube electrode potential, and cathode temperature and is an analysis of space charge limited current behavior as a function of cathode temperature. The usual assumption of electron emission from the cathode with zero initial velocity is replaced by the precise relationship in which an initial electron velocity distribution of Maxwellian form exists, dependent upon cathode temperature.

The criteria for tube drift with cathode temperature change is established as the required diode plate voltage (or equivalent grid sheet voltage for a multielement tube) change necessary to hold the plate current density constant when the cathode temperature is varied. It is shown that this voltage change is, to a first order approximation, proportional to temperature and decreases with a decrease in tube current density or electrode spacing down to a minimum value which occurs when the electrode spacing is such that emitted electrons arrive at the anode (or grid sheet) with an initial velocity imparted by the cathode. The change in voltage with temperature then increases again as the current density continues to decrease. Minimum cathode temperature effect is obtained for small currents at moderate spacing or moderate currents at small spacings. The magnitude of this variation, however, is not greatly different for most usual ranges of tube currents or spacings.

Further, a consideration of contact potential is made in terms of the variation in cathode work function with temperature and it is shown that there exists a possibility of eliminating this source of drift with temperature if a proper emitter work function characteristic can be developed.

123 pages. \$1.65. Mic 56-3370

**D-DECOMPOSITION ANALYSIS  
OF AUTOMATIC CONTROL SYSTEMS**

(Publication No. 19,108)

Rolf Wolfgang Lanzkron, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Thomas J. Higgins

The purpose of this thesis is threefold: to direct attention to a powerful means of servomechanism analysis of which nothing has been written hitherto in English; to develop a critical, integrated and well-detailed account of the theory enabling servomechanism analysis by this method of D-decomposition; and to exemplify application of each phase of this development by illustrative numerical examples.

Neimark, a Russian mathematician, originated the method of D-decomposition for use in his work on delocating the zeros of polynomial expressions. The possible use of his procedure for demarking the domain of stability of a control system, thus as a stability criterion in the same

sense that Cauchy's principle of argument provides a procedure for demarking the domain of stability in the guise of Nyquist's well-known criterion, was remarked by Soldovnikov and Meerov. A reading of their several papers shows the present state of the development of the method of D-decomposition roughly parallels that of the somewhat kindred root-locus method in Evans' original work in 1948.

Now it is possible to develop the method of D-decomposition in much the same degree as has been done for the root-locus method during the last eight years; and as the possibilities of use are fully as great and the facileness and flexibility of use even better than for the root-locus method, it is obviously most desirable that this be done. Precisely such is effected in this thesis; and the values of it are as just stated.

The scope of the thesis, is to be summarized as follows. Chapter 1 remarks the foregoing possibilities of the use of D-decomposition. Chapter 2 comprises a development of the basic theory of D-decomposition by a general polynomial expression, the characteristic function of a linear lumped-parameter servomechanism. Chapter 3 advances the basic theory of parametric stability analysis. Chapter 4 presents an exhaustively-detailed account of basic theory of servomechanism analysis for a unity-feedback system by the method of D-decomposition, wherein gain is taken as the variable parameter. Chapter 5 comprises an equally-detailed complement of the theory underlying determination of transient response by the method of D-decomposition. Chapter 6, based on unity-feedback theory developed in Chapters 4 and 5, generalizes application of D-decomposition methods to servomechanisms with numeric and, more broadly, frequency-dependent feedback. Chapter 7 entails account of D-decomposition theory pertinent to improvement of operating performance by network compensation. Chapter 8 develops D-decomposition analysis for sampled-data servomechanisms. Chapter 9 delineates the theory of D-decomposition pertinent to analysis of system with three (or more) variable parameters. Chapter 10 comprises a summary of essential results. A bibliography of 46 items concludes the thesis. 149 pages. \$2.00. Mic 56-3368

the grid. An assumption is made and verified experimentally with an equivalent circuit, that the grid current nonlinearity introduced into the plate circuit through the four terminal linear network is negligible for small values of feedback factor. This permits the isolation of the grid from the plate for certain analytical purposes, and it is possible to determine parameters for the amplifier. Two transcendental equations are obtained when the polynomial expressions for the plate and grid currents are substituted into the differential equations for the network. Since the circuit operation depends only on the driving voltages once the control characteristics have been determined and the bias has been fixed, it is possible to assume polynomial solutions for plate and grid currents in terms of driving voltages and unknown coefficients. These assumed solutions are substituted into the transcendental equations above, and the unknowns are evaluated by equating coefficients of like powers of driving voltage.

Next the equations for the amplifier are rewritten so that the plate and grid currents are functions of plate control, grid control and driving voltages. Expressions which define conditions in a generalized oscillator circuit are then obtained by equating the driving voltages to zero. The simultaneous solution of these network equations yields a single transcendental equation which involves only network parameters and plate control voltage. A solution for the plate control voltage is assumed and substituted into the transcendental equation, which is then rearranged into like powers of voltage. Conditions necessary to produce oscillations, amplitudes of various voltage components and the corresponding frequencies are determined by equating the coefficients of the powers of voltage to zero.

The results obtained for the generalized condition are applied to a tuned-plate oscillator. The physical parameters for this network are determined and the predicted values for the output voltage components are calculated for various settings of feedback factor and bias. The theory in this thesis is verified by the agreement between these calculated values and those obtained from measurements of the physical circuit for corresponding operating conditions.

99 pages. \$1.50. Mic 56-3371

#### A MATHEMATICAL ANALYSIS OF NONLINEAR FEEDBACK AMPLIFIERS

(Publication No. 18,164)

Phillip Nelson Larsen, Ph.D.  
University of Illinois, 1956

An important class of problems encountered in electrical engineering involves a closed loop system which contains more than one nonlinear element. This thesis presents a method for determining a steady-state power series solution to a particular problem in this class; that of closed loop triode amplifier or oscillator in which both the grid and plate currents are nonlinear.

The circuit is first considered as a generalized amplifier in which grid and plate currents are represented by polynomial functions of grid and plate control voltages respectively, and all driving generators are contained within a four terminal linear network that connects the plate to

#### THE USE OF CORRELATION TECHNIQUES IN THE STUDY OF LINEAR AND NON-LINEAR SERVOMECHANISMS

(Publication No. 19,142)

Morton Gailend Spooner, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Vincent C. Rideout

The analysis of linear systems has long been based upon the sinusoidal or transient approach. In laboratory testing of systems, or of their analogs, sinusoidal or step inputs have been most commonly used. With the recognition of the fact that, in many cases, the actual input signals can only be statistically defined, there has been a growing tendency to use such random inputs for test purposes.

Of great interest today is the study of systems incorporating non-linearities, both incidental and intentional.

Here the response to one waveform bears little relation to the response to another waveform, unlike the linear case. In such systems, therefore, the use of random inputs which are statistically similar to actual inputs is particularly important.

Analytically, if the mean-square error criterion is acceptable, the use of random inputs leads to the use of correlation functions. A new function, called the generalized error function, has been defined. It may be related to the correlation functions, if the mean-square error criterion is used, but it is more general and meaningful than this criterion. The correlation and generalized error functions have been studied analytically, for first- and second-order systems, with and without non-linearities. Curves of cross-correlation and generalized functions for the linear systems have been obtained by digital means.

Variational calculus methods have been used to minimize the generalized error function at a particular value of delay. This minimization procedure yields a result which relates the auto- and cross-correlation functions. Also, a mean-square correlation error calculation for a second-order linear system has been carried out by digital means.

Experimentally, if random inputs are used, the system must be examined for a much longer time than if sinusoidal or step inputs are used. A high-speed correlator and analog computer have been very useful, therefore, particularly for the study of the response of such systems as relay servos to random inputs. The relay servo has been compared, though the use of the analog correlator and the generalized error function, to a second-order system with and without non-linearities.

134 pages. \$1.80. Mic 56-3372

#### ENGINEERING, MECHANICAL

##### TRANSVERSE VIBRATION OF BEAMS CAUSED BY AN AXIAL MOTION OF ONE END

(Publication No. 18,837)

Gerald Allen Cohen, Ph.D.  
Purdue University, 1956

Major Professors: Hsu Lo and Bayard E. Quinn

The center-line of a thin clamped-free beam is a plane curve slightly different from a straight line. The clamped end is given a motion along a line tangent to the beam center-line at the clamped end. This investigation studies the resulting transverse oscillation of the beam. The differential equation of motion for such a beam is derived from the Bernoulli-Euler bending formula. The solution has a linear dependence on the unstrained beam shape, and has approximately a linear dependence on the acceleration of the clamped end for oscillations which are small compared to the unstrained beam deflection. Differential equations for the normal coordinates, which arise as the coefficients in the expansion of the solution into a series of eigenfunctions of the beam, are obtained.

For the special case of a uniform beam with a

parabolic unstrained shape and a clamped-end acceleration given by

$$F(t) = ae^{-bt} [(bt)^2 - 4bt + 2]$$

numerical solutions to these differential equations were obtained. These were computed by using Purdue University's Electrodata digital computer, which employed the Runge-Kutta stepping-ahead process. These solutions are presented in the form of graphs of free-end deflection, slope, and transverse velocity as functions of time. A region is determined on the  $a, 1/b$  plane in which the oscillation may be considered as having linear dependence on the clamped-end acceleration.

Application of these numerical results is given in the form of a dispersion calculation for a machine gun projectile. The conclusion of this calculation in conjunction with experimental dispersion data is that for the weapon fired barrel vibrations of the type considered contribute very little to the actual dispersion.

Although no numerical results are obtained for periodic clamped-end motions, the solution for the oscillation in this case is given for the case of small oscillation compared with the unstrained beam deflection.

79 pages. \$1.50. Mic 56-3373

#### ENGINEERING MECHANICS

##### ELASTIC BUCKLING OF A SIMPLY SUPPORTED RECTANGULAR SANDWICH PANEL SUBJECTED TO COMBINED EDGEWISE BENDING AND COMPRESSION

(Publication No. 19,102)

William Robert Kimel, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Raymond J. Roark

A theoretical analysis is made of the problem of the elastic buckling of a simply supported rectangular sandwich panel acted upon by any combination of edgewise bending and compression on opposite edges. The solution is based on the assumption that the sandwich panel is composed of isotropic plate facings of unequal thickness and an orthotropic core subjected only to anti-plane stress. The mathematical solution of the problem is based upon a Rayleigh-Ritz energy method using a double Fourier series with configuration parameters which are constants of integration obtained from solution of the core equilibrium equations. The specific method of approach is thought not to have been previously applied in sandwich analyses. The solution is in the form of a characteristic determinant of order infinity, except in the special case of pure edgewise compression, in which case the determinant is of order six. Evaluation of an order eighteen principal minor from the determinant of order infinity is made to obtain data for design curves.

Design curves are compiled for the case of pure edgewise compression and for the case of pure edgewise bending. These design curves are based on the additional assumptions of modified flexural rigidity of the facings and

infinite transverse modulus of elasticity of the core. Formulas are presented for the calculation of design curves for other combinations of edgewise bending and compression. 140 pages. \$1.85. Mic 56-3374

**CAM DYNAMICS**  
(Publication No. 18,861)

Samuel Mercer, Jr., Ph.D.  
Purdue University, 1956

Major Professor: A. R. Holowenko

A method of analysis employing numerical techniques was proposed for studying the dynamic characteristics of cam forms. The purpose of organizing the analysis for digital computation was to provide a general method that could be applied to the study of any cam contour. Employing the proposed method, cam contours based on a constant acceleration, a sine acceleration, a modified trapezoid acceleration, and two other acceleration functions were analyzed. The results checked those of exact mathematical methods within a fraction of one percent.

Certain similarities were observed between the Fourier analysis of a cam acceleration function and the calculation of residual vibrations after a single acceleration-deceleration pulse. This led to a means of predicting the cam speeds at which resonant buildup of vibrational stress was likely and to a means of determining from the results of a single pulse analysis the strength of this resonant tendency. By this method the effect of dwells was studied. It was found that for a given cam rise time, the effect of increasing the length of the dwell period was to increase the number of cam speeds at which resonant tendencies occurred. Two cam forms not discussed previously in the literature were analyzed. Acceleration functions for these cams were composed of arcs of sine and cosine functions so as to produce continuous jerk curves. The residual vibration characteristics and resonant stress buildup tendencies for these cams were studied. For limited ranges of cam speeds these forms were found to be superior to cam contours based on a sine or modified trapezoid acceleration function.

111 pages. \$1.50. Mic 56-3375

**ENGINEERING, SANITARY AND MUNICIPAL**

**A STUDY OF THE EFFECT OF A SINGLE INFLUENT  
OPENING ON SEDIMENTATION IN A TANK**

(Publication No. 18,831)

William John Boegly, Jr., Ph.D.  
Purdue University, 1956

Major Professor: D. E. Bloodgood

The review of the literature indicated that although the initial paper on the theory of sedimentation was presented

by Hazen in 1904, little experimental work has been carried out on the theory of sedimentation. As far as the effect of influent velocity was concerned, there were many theories proposed, but again there was no experimental analysis.

As a result, the work of this thesis was undertaken to determine the effect influent conditions had on the removal of solids in a settling tank. This study is a continuation of the research project at Purdue University entitled "Sedimentation Studies." Funds for the project were supplied by the Federal Security Agency, Public Health Service, National Institutes of Health.

The equipment used in this study consisted of a settling tank, a slurry mixing tank, pumps, flow meters, a slurry concentration measurement device, and a quiescent settling tube. The settling tank was so constructed that each of its dimensions could be varied. In this study the tank size used was 14.5 feet long, 6.0 feet wide, and 1.1 feet deep. The slurry mixing tank was used to produce a slurry from the dry sediment. The sediment used in this study was Celite 545, a diatomaceous silica product. The pumps and flow meters were used to provide and measure the flow of both slurry and influent water.

In this study a single influent opening was used in the settling tank. The opening was located at the influent end of the tank, and was situated at a depth of one half the water depth in the tank, and equal distant from each of the side walls. Three sizes of influent opening were used in this study. They were: 0.0142 square feet, 0.00601 square feet, and 0.0021 square feet. For each size of influent opening the flow through the tank was varied in order to produce different influent velocities. In all, twenty-two tank data runs were made in this study.

The results of the tank runs indicated that the percent removal in the settling tank was inversely proportional to the product of flow and influent velocity. This product was found to be similar to the force of a jet striking a flat plate at right angles to the direction of flow. This expression is:

$$\text{Force} = \frac{Q V_0 w}{g}$$

Where: F = Force of the jet in pounds

Q = Flow through the nozzle in c.f.s.

V<sub>0</sub> = Velocity of water at mouth of nozzle  
in ft./sec.

w = Unit weight of water (62.4 lbs./cu.ft.)

g = Acceleration due to gravity  
(32.2 ft./sec./sec.).

The influent force was calculated for each run and was plotted against the percent removal. A least squares curve fitting procedure was applied to this data, and the following equation was obtained.

$$\text{Percent Removal} = \frac{95.26}{2.021 \text{ Force}}$$

A series of quiescent settling analyses were made on the sediment used in these tests (Celite 545). These analyses indicated that the percent removal, in quiescent settling, could be represented by the following equation.

$$\text{Percent Removal} = \left[ 100 - \frac{97.82}{1.062 \text{ Time}} \right]$$

The quiescent settling properties of sewage were also studied. This study indicated that the Celite settled more rapidly than the sewage, but no relationship could be found which would relate the Celite settling properties to sewage settling properties.

Using the quiescent settling properties of the sediment in these tests (Celite 545), it was possible to calculate the portion of the settling tank which was used to still the influent water. The results of these calculations were given by the following equation.

$$L_s = 7.97 (10F)^{.124}$$

Where  $L_s$  was the stilling length in feet and  $F$  was the influent force in pounds. 128 pages. \$1.70. Mic 56-3376

#### ACID FORMATION IN SEWAGE SLUDGE DIGESTION

(Publication No. 17,344)

Gerald Howard Teletzke, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Gerard A. Rohlich

A problem encountered in the anaerobic fermentation of sewage solids is the occurrence of excessive amounts of organic acids in the digesting mixture. At the present time, the determination of the volatile acids in sludge is used as a control test in the digestion process. The individual acids present cannot be determined by this method. Quantitative information on the individual organic acids, found during the various stages of digestion of different types of sewage sludge, is meager.

The objectives of this study were: (1) to apply the procedure of partition chromatography to the separation of the individual organic acids present in sewage sludge; (2) to determine quantitatively the major organic acids found in different types of sewage sludge at various stages of digestion, and (3) to determine the effect of agitation on the rate of acid production in the digestion of sewage sludge.

A chromatographic method was adapted for determination of the individual water-soluble fatty acids occurring in sewage sludge. A simplified chromatographic procedure, to replace the existing standard method, is suggested for the routine determination of the total fatty acid content of sewage sludge.

Batch digestions of seeded and unseeded raw sewage solids, packing house sludge, and sludge containing activated sludge were conducted at 35° C. The individual organic acids present, and the gas produced during the course of digestion, were determined. Acetic, propionic, butyric, and valeric acids were found during all digestions. A period existed at the beginning of the digestions when all organic acids increased rapidly. This period varied from one day in sludge containing activated sludge, to nineteen days in seeded raw sewage solids. After the maximum organic acid concentration had occurred, acetic acid was the first acid to decompose.

The results obtained from the digestions indicated that gas production in the digestion of packing house sludge will proceed in the presence of higher organic acid concentrations than in the digestion of raw sewage solids. The total organic acid concentration in packing house sludge reached a value of 126.0 meq/liter after seven days of incubation and then decreased as gas was produced. The organic acids in unseeded raw sewage solids increased throughout a 79 day digestion period to a total of 107.2 meq/liter; gas production ceased before the twentieth day of digestion.

Experiments were conducted in which undisturbed sludge and constantly agitated sludge were digested. The amounts of gas and individual acids formed in each digestion were determined and compared. The results indicated that the organic acids increased initially at a higher rate in an agitated digestion than in an undisturbed digestion. In an agitated digestion of seeded raw sewage solids, the total organic acid content of the digestion reached a maximum concentration of 76.0 meq/liter on the ninth day of digestion; the organic acid content of the undisturbed digestion reached a maximum concentration of 70.0 meq/liter on the nineteenth day of digestion. At the end of six days, in the digestions studied, the volume of gas produced from an agitated digestion was about twice that produced from an undisturbed digestion. Until the twenty-second day of digestion, gas was produced at a higher rate from the agitated digestion. From the twenty-second to the forty-seventh day, when digestion was terminated, gas was produced at a higher rate in the undisturbed digestion. By the forty-seventh day, equal volumes of gas had been produced from both digestions.

In experiments in which sludge mixtures were exposed to the atmosphere for a short time each day, the results showed that digestion was retarded by agitation.

123 pages. \$1.65. Mic 56-3377

## FINE ARTS

### THREE ORIGINAL THREE-ACT PLAYS

(Publication No. 18,523)

Jean Speller Browne, Ph.D.  
State University of Iowa, 1956

Chairman: Dr. William R. Reardon

The 1896 Scene of the dramatic chronicle, Never Ending Frontier, presents the problems of education in Iowa in the last decade of the nineteenth century, the crying need for better trained teachers, and a program geared toward the rural school in a state that was then predominantly rural. The action takes place at a birthday party in honor of a distinguished teacher, Phoebe Sudlow. The blindness of the unthinking layman, as well as the stupidity of the old-fashioned, untrained teacher, is represented in Mrs. Cobb who arrives at the party unexpectedly and manages to make somewhat of a fool of herself. Martha Adams, a teacher, and Allen Reed, a politician, are at opposite poles on the question of the importance of education, but Martha, aided by her amused and tolerant older associates, manages to bring young Reed down to defeat, and the cause for education triumphs.

The 1954 Scene is the story of the gallant efforts of the all too few who are trying to bring education up to modern standards in present-day Iowa. Sam Douglas, a county superintendent of schools, aware of the inadequacies and retarded development of the entire system both in curriculum and in the physical plant, has just finished a vigorous campaign for reorganization. He has been aided in this by a progressive and far-sighted teacher, Martha Adams, and a few big-spirited members of the general public who realize that education is as important as big business and more deserving of monetary support than war. The vote comes in against reorganization. The eighty-three-year-old one-room school house where this scene takes place seems to be here to stay, but there is a strong feeling that Sam Douglas and Martha Adams will continue to fight until the apathy of the public is overcome.

A Way For Duncan is the story of a father and son and their search for understanding of each other and of life. It is Scott McClain's philosophy that every man is put on earth for a purpose and that his happiness and security lie in finding and working in that way of life. He himself, after much personal sacrifice, has found his purpose in helping delinquent boys, but faced with his own son's problems, he finds it difficult to be objective. His son, Duncan, is torn between two ways of life -- the material pleasures of his mother's world, and the more solid, though to him rather doubtful, pleasures of a life of giving. In the end, faced with a crucial decision between the two worlds, the few months spent in the school and his association with his father outweigh the years of his mother's influence. Prodded by his young and understanding wife, and a series of circumstances cleverly arranged by Scottie, he suddenly sees clearly which way he was meant to go.

The historical setting for Prelude to Revolution is the Bacon Rebellion of 1676 in Colonial Virginia, but the story

concerns itself with the inner conflict of Nathaniel Bacon himself, a quick-tempered and impatient young man of wealth and breeding whose hatred of injustice leads him to champion the people's cause against their arrogant and bigoted old Governor, Sir William Berkeley. It shows how he unthinkingly, almost blindly, rused step by step from foolhardy but honest outspokenness to open rebellion, and how, finally, his motives changed from the unselfish ones of the humanitarian to those of personal aggrandizement and revenge, thus bringing about his downfall.

425 pages. \$5.45. Mic 56-3378

### THE SYNTHESIS OF DECORATION WITH OTHER DESIGN ELEMENTS: A PRESENTATION OF CERAMIC PIECES

(Publication No. 18,786)

Murray Alanson Douglas, Ph.D.  
The Ohio State University, 1956

The development and role of decorative treatments in the plastic arts has historically received the attention of artists, and continues in contemporary times to pose aesthetic problems. The dissertation represented a search for personal improvement in ability to invent decorations and to synthesize them with other elements contributing to expressive and functional ceramic pieces. The dissertation was creative in nature, and consisted mainly of the production of concrete examples of decorated pottery. An exhibition of forty selected pieces was the culmination of the work.

Since the body of the dissertation was studio work, the problems pursued were in the realm of both ideas and physical application. Fundamentals common to the arts had to be incorporated. A constant effort to achieve formal aesthetic standards was implicit in the undertaking. Problems unique to ceramics and its decoration were pursued. Technical aspects of tools, clay, glazes, and kiln behavior were investigated, as were ornamental processes and subsidiary materials. The manipulation of the clay into controlled forms was not only necessary in order to investigate various appropriate decorations but was also a creative challenge. Further problems accompanying the formal and physical ones involved in decoration were those personally held viewpoints which determine the directing of effort.

Solutions of some of the problems are embodied in the various ceramic pieces. Items selected for exhibition were those in which the decoration was believed to contribute to the worthiness of the whole.

For purposes of documentary reference, a visual record was made of the exhibition pieces in the form of a photographic statement. Of the fifty illustrative plates, many contain multiple views of various pieces in order to better project details of form and decoration. Some plates are in color to give a sampling of the range of colorations

employed. Accompanying each plate is information descriptive of the specific piece.

Supplementing the illustrations is such text as is pertinent to a broader understanding of concepts which initiated or emerged from the work. The content of the written material pertains to purposes, meanings, relationships, and processes involved in achieving satisfactory decorated ceramic wares. The text is divided into three major sections. The first part deals with the interdependence of ceramic shape and decoration in their confluence with each other. The second part deals briefly with the need for fresh decorative symbols to convey contemporary meanings and with the complexity of symbolic reference which a decorated ceramic piece may contain. Presented last are some considerations of the richly expressive language available to ceramists in the way of characteristic materials, tools, and equipment.

Concluding the record are appendixes of chemical data on bodies, slips, and glazes used to create the earthenware, stoneware, and porcelain pieces illustrated.

149 pages. \$2.00. Mic 56-3379

**ABSTRACT FORM IN PICTORIAL EXPRESSION,  
WITH A STATEMENT OF  
THE ARTIST'S FORMAL DEVELOPMENT**

(Publication No. 18,802)

David Dalrymple Ketner, Ph.D.  
The Ohio State University, 1956

It is necessary to make clear at the outset the purposes of a written adjunct to what is primarily a studio dissertation. In the past, artists have seldom felt the need to justify the activity of painting, even though there have been those who have questioned its validity. Since the turn of the century, however, artists of necessity have turned to linguistic means to make their art more comprehensible. This change has occurred in part because of the increasing drift away from the inclusion of literary elements in painting and because of the fact that art has come to mean commercial illustration as well as what is termed fine art. Those works which are now devoid of popular myths or scenes of natural beauty automatically preclude great numbers of observers who come to art for an illusion of visual reality. The rift between artist and public becomes sharpened when increasing numbers of artists become committed to an autonomous art form which does not serve this end. Without the element which laity equates with a practical virtue, the activity of making such art objects becomes almost meaningless. It is this estrangement which is at least partially responsible for the artist's literary efforts in defense of the activity, if not the style, in which his visions are manifested. It is a truism that words may not serve the artist in the way he would prefer, but can, in many instances, give fresh insights into his artistic development and may serve as a means to greater, if extra-aesthetic, apprehension of the works themselves. The purpose of this exposition, then, is not to substitute for the dissertation proper, which is in all ways visual. It is rather to act only as a preface which includes a compendium of the visual-intellectual experiences which I feel have been most notable in the conditioning of my art to its present status.

The compendium begins with pre-school artistic activity and moves through formal instruction at the Cornish School of Music and Art, the University of Washington, and Estudios Universitarios de Mexico City College. Parallelizing the instruction was a growing sense for abstract, formal elements of painting. The compendium concludes with the experiences at the Ohio State University, which are objectified in the paintings and drawings presented as the dissertation proper.

Since the beginning of the century the artist has experienced a new freedom, and one of the vicissitudes of this freedom is the necessity for each artist to find a personal means of expression since we cannot appeal to an academy for a style or a *raison d'être*. For my own part, although I work with non-representational elements, it is characteristic of this freedom that I may move to recognizability with ease and without creating a dichotomy, since it is the manner in which I perceive which is important and is constant, whether it is mountains and trees or the emergent forms of a non-cognitive painting in process.

45 pages. \$1.50. Mic 56-3380

**NON-DESCRIPTIVE PAINTING:  
AN ARTIST'S POINT OF VIEW**

(Publication No. 18,819)

Karl Frederick Richards, Ph.D.  
The Ohio State University, 1956

The major purpose of this manuscript is to present a concept of non-descriptive art as meaningful. The attempt to ascribe meaning to a non-cognitive art form is probably a unique endeavor, but it is nevertheless attempted on the basis of an artist's conception of the nature of meaning. The major distinction made is that between cognitive meaning and aesthetic meaning, and the effort is made to distinguish between meanings symbolically evoked and those perceptually apprehended in the absence of symbols. Consistent with the various aspects and purposes of this discourse, various kinds of meaning are defined and discussed. The communicative and creative values of perception are considered from a non-descriptive point of view, and the sources and methods of the non-descriptive artist are contrasted with those of the descriptive artist.

Cognizance is taken of the conflict which has arisen between the descriptive and non-descriptive schools of thought. And the widespread lack of appreciation for non-descriptive art is considered from various standpoints. The viewpoint is adopted that both descriptive art and non-descriptive art are subject to the same aesthetic "laws" and that the usual criticisms of non-descriptive art are, in fact, rather superficial and insignificant when examined in the light of non-descriptive intentions.

The manuscript represents a pause or tentative position in the creative development of an artist, and it expresses deeply personal responses to a particular kind of creative activity in relation to a complex and sometimes unsympathetic social environment. It presents a personal attitude towards the significance of non-descriptive art in relation to the aesthetic sensibilities of contemporary American society.

Accompanying the text is a series of photographic color reproductions of some of the author's non-descriptive paintings.

114 pages. \$1.50. Mic 56-3381

## FOLKLORE

### A TYPE AND MOTIF INDEX OF JAPANESE FOLK-LITERATURE

(Publication No. 17,957)

Hiroko Ikeda, Ph.D.  
Indiana University, 1956

Systematic collecting of folklore material by Japanese folklorists started from around 1910, and by 1950 nearly 20,000 folktales of oral tradition had been recorded. Arranging and classifying of the material have been done in Japan, following the standard order and types set by Kunio Yanagita, who has been the leader of Japanese folklore studies for nearly fifty years. Other than the oral source material, Japan is rich in written records, the earliest in existence dating back to 712 A.D. This means that some of our folklore material may be traced back as early as that date.

For the purpose of correlating Japanese folktales with European tale-types indexed in the Aarne-Thompson Index, approximately 2894 versions of folktales have been singled out and analysed. When necessary, other forms of folk-literature such as local legends, historical epics, and written sources of earlier date have been considered. Altogether 205 types have been established as counterparts of the types in the Aarne-Thompson Index. The motifs included in these types have been compared with Thompson's Motif-Index of Folk-Literature, so as to verify my judgment in establishing the analogues. A list of these motifs together with the second list of other Japanese motifs furnish a general motifs-index to Japanese tales.

The varied behavior of "Animal Tales" seems to

suggest their ancient ancestry. The north European Bear Cycle has been dismembered into separate episodes which combine with tales of different origin and nature, and form entirely new stories. In some types, the trickster and the dupe completely exchange their roles. In others, the rabbit, the hero of south-east Asiatic animal tales, becomes the trickster. Some tales are told as adventures of the fox which is believed by the folk to be a mythical animal. Versions belonging to the cycle of "Kachi-kachi Mountain," one of the best known tales in Japan, consist of from one to eight parts taken from ten different tale-types, varying in different localities. There is a total of thirty-two variations in the combination of these different types.

When the versions belonging to a type are diversified in details, when some elements in a type wander out and combine with some other types or elements, or when the type has attached itself to a certain local object or religious site and the versions of the type are told as local legends, the probability is that the type is of considerable age. Such are Types 300-303, 313, 328, 400, 425, and 465, of "Regular Tales."

Travelling story-tellers of religious nature, of both sexes, and oftentimes blind, together with peddlers and traders, have had a great deal to do with the diffusion of folktales in Japan. Specialization of repertory seems to have developed especially between the sexes, women-tellers having an inclination for sentimentality, while men-tellers favored jokes and tall-tales.

In the treatment of each type are given the distribution of the versions in Japan, a comparative analysis of the material, and some references to the tales of neighboring countries.

403 pages. \$5.15. Mic 56-3382

## FOOD TECHNOLOGY

### THE EFFECT OF HEAT ON THE ELECTROPHORETIC PROPERTIES OF MILK PROTEINS

(Publication No. 18,791)

Kenneth Karl Fox, Ph.D.  
The Ohio State University, 1956

The effect of heat on the milk protein system is of interest in that it affects the stability of the protein suspension and produces changes within the protein components. By electrophoresis, changes within a complex system such as the milk protein system may be followed by changes in the mobilities of the individual components and in their relative areas.

In the study, the effect of heat on the individual components of milk as well as on the intact system was investigated by means of electrophoresis. Casein was separated into two fractions distinguishable from each other by their

reactivity in the presence of calcium ions. It was found that the fraction not precipitable by calcium formed a heat-stable complex with  $\beta$ -lactoglobulin when heated with this protein. The calcium-precipitable fraction did not react with  $\beta$ -lactoglobulin on heating, and the  $\beta$ -lactoglobulin was coagulated by the heating conditions employed. When  $\beta$ -lactoglobulin was heated in the presence of both components, a heat-stable complex was formed, but its electrophoretic properties were different from those of the complex formed in the absence of the calcium-precipitable fraction.

An electrophoretic examination of milk heated to different temperatures for 30 minutes revealed a decrease in the relative area of the  $\beta$ -lactoglobulin boundary with a corresponding increase in the area of the  $\alpha$ -casein boundary when milk was heated to temperatures of  $65^{\circ}\text{C}$ . and above. Since an interaction between  $\beta$ -lactoglobulin and the fraction of casein not precipitable by calcium was

found to occur, this reaction in normal milk on heating was to be expected.

When the normal whey protein concentration of milk was increased by the addition of concentrated whey proteins, two or more components were displaced from the  $\alpha$ -casein boundary of both heated and unheated milk. During electrophoresis, one of the displaced components migrated between the  $\alpha$ -casein boundary and the boundary ascribed to  $\beta$ -lactoglobulin. The other component was found in the false boundary on the ascending side. This result indicates that the protein constituents of milk exist in a unique state of equilibrium with each other.

When milk was heated to 75° C. for different periods of time, and the mobilities of the  $\alpha$ - and  $\beta$ -casein boundaries plotted as a function of the time of heating, two discontinuities occurred in the resultant graphs. The first discontinuity could be related to a decrease in the area of the  $\beta$ -lactoglobulin boundary and a corresponding increase in the area of the  $\alpha$ -casein boundary. The second discontinuity could not be associated with changes in area of component boundaries, and is therefore considered to represent an intramolecular type of reaction within the  $\alpha$ -casein. Not all lots of milk reacted the same to the same heating conditions, a feature well known from a practical viewpoint.

A relation associating boundary spreading during electrophoresis to heterogeneity and diffusion coefficients for proteins stable and soluble at their isoelectric point was applied to electrophoretic data of  $\alpha$ -casein at pH 6.5. True values of the heterogeneity and diffusion coefficients were not obtained because of pH and conductivity effects. Results of value for comparative purposes were obtained which were consistent with the known effects of heating on the casein micelle. 115 pages. \$1.50. Mic 56-3383

#### SPREADABILITY, BODY, AND TEXTURE OF BUTTER

(Publication No. 19,096)

Victor Robert Huebner, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Louis C. Thomsen

An instrument was developed to measure the hardness and spreadability of butter. All determinations were conducted in a room held at 55.5 ± 0.5°F. There was a highly significant correlation between the spreadability results obtained by the instrument and those obtained by consumer tests.

It was found that the hardness and resistance to spreading of butter would be slightly decreased if very high or very low testing cream was used, if sweet cream rather than whey cream was used, if emulsifiers were added to butter, and if butter was worked at a low temperature.

No significant effects were noticed from variations in the salt balance or degree of oiling-off of the cream, or from the moisture content of the butter.

A highly significant correlation was obtained between the hardness and spreadability of butter and its iodine value.

Butter which had been churned from rapidly cooled pasteurized cream was harder and less spreadable than

when such cream was slowly cooled. If cream was held at a higher temperature (58°F.) after pasteurization, the resulting butter was much softer and more spreadable than if the cream was held at a lower temperature (38°F.).

Butter stored at a temperature of 36°F. or 55°F. rapidly became harder and less spreadable during storage. Temperatures of below 25°F. prevented this hardening phenomenon from occurring. Butter stored at 36°F. and then stored at -6°F. became softer and more spreadable.

Trials in which both the holding temperature of cream and the storage temperature of butter were varied indicated that each of these treatments exerted independent effects upon the butter structure. The softest and most spreadable butter was produced when the cream was held at 58°F. before churning and the resulting butter was stored at -6°F.

Experiments were conducted using two different types of machines to print butter. One of the machines was designed to handle butter at a temperature of around 36°F. while the other would handle butter at a temperature of 48°F. It was found that the butter printed at 36°F. completely lost its hard crystalline structure when printed and did not completely regain it upon subsequent storage. The butter printed at 48°F., however, was not as thoroughly reworked. This was evidenced by the fact that butter printed at 48°F. did not revert to its original degree of softness and spreadability but was harder and less spreadable than it was immediately after churning.

Theories are presented which attempt to explain these phenomena in physico-chemical terms.

129 pages. \$1.75. Mic 56-3384

#### LINDANE RESIDUE IN THE FERMENTATION AND PROCESSING OF PICKLES

(Publication No. 18,583)

Melvin Roscoe Johnston, Ph.D.  
University of Missouri, 1956

Supervisor: Raymond A. Schroeder

An investigation was made of the influence of lindane residue on the microflora of the cucumber fermentation and the flavor of the processed pickles. Particular emphasis was given to the physiological relationship of lindane (gamma-hexachlorocyclohexane) and i-inositol in the metabolism of bacteria, mold and yeasts.

Pickling cucumbers were found to contain 10 to 11 ppm of lindane when sprayed (after harvest) with one pound of 25 percent lindane per 100 gallons, which produced from 2 to 4 ppm in the pickles. Insect control schedules with seven applications prior to harvest resulted in a lindane residue of less than one ppm on the cucumbers and the pickles contained less than 0.5 ppm. When lindane was added to the fermentation vats, at the rate of 10 ppm (brine and cucumbers), the salt stock contained 7.3 ppm; whereas an equal amount of inositol and lindane (10 ppm each) resulted in 4.25 ppm in the salt stock and the pickles contained 7 and 3 ppm, respectively.

With a high (10 ppm) residue of lindane, the fermentation was altered. Lactic acid production was stimulated

by the lindane. Yeast population was lower and lactic acid producing bacteria were higher in the lindane treated vats. Residue from field spray plots did not alter the fermentation. Pure cultures of bacteria, mold and yeasts were inhibited by lindane to a varying degree. Yeasts, especially those requiring exogenous inositol were inhibited by lindane which could be counteracted by the addition of inositol. The demonstration of this effect on yeast in the "natural" flora was not as clear cut.

The flavor of pickles was affected by lindane at high (10 ppm) concentrations. The flavor was not repulsive or objectionable to the taste panel, but it was distinguishable from the control at a highly significant level, (dill and sweet, but not sour). Inositol was found to counteract the effect of lindane on pickle flavor. The lindane residue from field insect control schedules did not alter the flavor of the pickles. 212 pages. \$2.75. Mic 56-3385

#### A NEW APPROACH TO THE DRYING OF MILK

(Publication No. 19,101)

Elwood William Kielsmeier, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William C. Winder

Milk drying has commanded much attention over a period of many years and a wide variety of methods and devices has been developed in an effort to produce a satisfactory product. The dried whole milk currently being offered for sale is manufactured almost exclusively with spray driers. The product prepared by the spray drying process is very difficult to reconstitute with water. After reconstitution, the milk has a pronounced cooked flavor and it creates an unpleasant chalky sensation in the mouth of the consumer. As a result of these reconstitutability and flavor defects, the product has not competed seriously with fluid whole milk in the domestic market. The defects apparently are a result of the high temperatures employed in the processing operations.

The prime concern of the present work was the development of a process for drying whole milk that would minimize or eliminate the defects found in commercial spray dried whole milk. This was accomplished through the use of low processing temperatures.

For reasons of economy, milk is condensed before it is dried. The condensed milk used in the new drying process was prepared under conditions which resulted in a minimum of cooked flavor and chalkiness. Whole milk was pasteurized at 61.7° C for thirty minutes, homogenized at 20° C and 25° C.

Drying was accomplished with a vacuum apparatus in which evaporation could be carried out at vapor temperatures just above 0° C. The drier was equipped with electric heating elements which allowed heat to be applied over a wide range of intensity. Heat applications during drying were tailored to fit the changing solids concentration of the product in order that rapid drying could be combined with a minimum of protein insolubilization. The heat tailoring consisted of intense heating while much moisture was present in the product, followed by reduced heating in the later stages of drying. The results

indicated that protein insolubilization could be almost completely avoided if the temperatures and times, in drying from a solids concentration of 35 per cent to 87 per cent, did not exceed the values given by the equation  $Y = 39 - 15.4 \log_{10} X$ . In this equation, Y = degrees Centigrade and X = time in minutes. The values apply in a system operating at an absolute pressure of 4.8 ± 0.2 millimeters of mercury.

The resulting product, when reconstituted, had approximately the same flavor characteristics as reconstituted samples of the condensed milk from which it was made. The flavor of the reconstituted product compared favorably with that of fresh pasteurized, homogenized whole milk. Dried whole milk prepared by the method developed in the work had flavor and reconstitutability properties superior to those of the commercial spray dried whole milk with which it was compared. The desirable characteristics were attributed to the use of low temperatures throughout the processing operations.

Keeping quality studies on whole milk dried by the method developed in the work indicated that the product, when packed in air, had a storage life of less than 30 days, at room temperature. The main defect was an oxidized flavor.

Studies were conducted on methods of inhibiting oxidized flavor development. The studies included the use of high forewarming temperatures, gas-packing, low storage temperatures, pancreatic enzymes and butylated hydroxy anisole as an anti-oxidant. The most satisfactory result was obtained from low storage temperatures. Storage at 2° C resulted in a satisfactory life of between 60 and 90 days.

The results of the work suggested that the experimental process could be adapted to commercial equipment and that the product could be distributed as a refrigerated grocery item. 144 pages. \$1.90. Mic 56-3386

#### THE REACTION OF CULTURAL PRACTICES TO THE SPECIFIC GRAVITY AND CALCIUM CONTENT OF POTATOES AND THE EFFECTS OF THESE VARIABLES ON THE QUALITY OF POTATO CHIPS

(Publication No. 17,398)

Keng Chock Ng, Ph.D.  
The Ohio State University, 1956

The results of the total calcium\* determination of fifteen individual potato samples in 1954 and thirty-two variety samples in 1955 indicated that the high total calcium content of raw potato tubers was correlated with light-colored chips and low fat absorption.

The data for 1954 and 1955 indicated a high correlation between high calcium content of potato tubers and high total solids of these potatoes.

Early dug (July 8) Cobbler tubers in these tests had a higher specific gravity than those dug at later dates (July 22, July 29, and August 10). Low yields of chips were secured from Cobbler potatoes which were dug either very early (July 8) or very late (August 10).

Poorly colored chips were produced from Cobbler potatoes which grew with a high moisture level (3-foot tension) and at the latest digging date (August 10).

Chips with low fat content were produced from early dug Cobbler potatoes which grew on a low nitrogen level.

The potato tubers from early planting did not always have a high specific gravity, nor did they always produce light-colored chips.

In 1954 the average specific gravity of the tubers of eleven varieties of potatoes growing under irrigation was lower than when growing without supplementary water. Moreover, the chips produced from tubers growing under

irrigation on the average had a lower yield, a higher fat content, and a poorer color than those growing without irrigation.

High specific gravity potato tubers do not always insure good color chips. Variety is a very important factor.

130 pages. \$1.75. Mic 56-3387

\*In this paper total calcium refers to the sum of Calgon and hydrochloric acid soluble calcium.

## GEOGRAPHY

### THE GRADUATED CIRCLE: A DESCRIPTION, ANALYSIS, AND EVALUATION OF A QUANTITATIVE MAP SYMBOL

(Publication No. 19,085)

James John Flannery, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Arthur H. Robinson

The graduated circle is a graphic device which represents quantity by variations in the areal sizes of the circles proportionate to the values represented. The first known use of this graphic device was in 1801 by William Playfair in The Statistical Breviary. It apparently was first used as a map symbol by Henry Drury Harness in 1837. The primary use of the graduated circle today is as a map symbol. It is commonly used to map data which are by large statistical units, highly concentrated in their distribution or, because the circle is easily sectored, subdivided to show parts of a whole. It is a very popular and useful symbol.

The value of a quantitative map symbol can be determined by how well it fulfills certain criteria desirable in map symbols. The graduated circle satisfies many of these criteria. Of the desirable non-visual traits, it has the advantage of (1) easy conversion of data into a form suitable for symbolization, (2) speed in drawing, and (3) efficiency in the utilization of map space. Of the visual characteristics the symbol has the inherent advantage of (1) effective representation of the areal distribution of the data and (2) it is aesthetically pleasing. In the important matter of (3) presenting relative quantity, although the circle effectively presents complex and precise variations in quantity, it has one major flaw. The one negative "presentational" characteristic results from an apparent tendency of the average individual to underestimate the size differences, and therefore the value differences, of areally graduated circles. This phenomenon has been commented on by various authorities on graphics. If it is true then the graduated circle inaccurately presents relative quantities.

It is possible to rectify the malfunction of the graduated circle, but before this can be done it is desirable to determine if underestimation of size is a fact. Since nothing but subjectively derived opinion supports the various statements made regarding the predominance of underestimation such an investigation is necessary. Objective visual perception type tests were designed and given to a large number of individuals, and the results of these tests indicate conclusively the predominance of underestimation. Underestimation being verified, additional more comprehensive tests were given to derive a system or scale of graduating circles which would correct the deficiency. From the data obtained, the median estimates and the correct areal size were correlated and a final formula for varying circles on a visual or apparent size scale was determined. This formula is

$$X_c = 1.0166Y^{(1.1432)}$$

in which Y is the desired value or quantity to be conveyed to the reader,  $X_c$  is a computed, adjusted value necessary to create the desired (Y) impression, and (1.1432) is the power to which Y must be raised so that along with the factor 1.0166, X can be computed. Since the factor 1.0166 is so close to 1, it may be eliminated and a more convenient formula,  $X_c = Y^{(1.1432)}$ , substituted. Even this formula is a good bit more cumbersome than the traditional method of converting data into circles of various sizes. Consequently, another version,  $X_c = Y^{(.5716)}$ , is given. This formula when applied to a series of data yields values proportionate to which the radii of circles should be drawn. The procedure is to obtain the logarithm of Y, multiply it by .5716, and then find the antilog of this product. The resultant value determines the radius of a circle graduated on the apparent size scale. In addition various tables and graphs are given for values on the apparent size scale and the advantages and application of the new method of circle size graduation are indicated.

The apparent size scale represents an attempt to supplant a scale based on purely physical variations which create an erroneous impression of relative quantity with one based on tested visual variations.

181 pages. \$2.40. Mic 56-3388

**THE HISTORICAL AND REGIONAL GEOGRAPHY  
OF THE WILLAPA BAY AREA (VOLUMES I AND II)**

(Publication No. 18,794)

Jean Hazeltine, Ph.D.  
The Ohio State University, 1956

The dual purposes of the study were to investigate the historical geography of the area surrounding Willapa Bay, in the southwestern portion of the State of Washington, and to analyze the degree of regional separateness of the bay area from the beginning of settlement to the present. Concomitantly, as an additional project, the different geographic and nongeographic factors were examined and appraised as they affected the development of the area. Analyses of the three phenomena of settlement and population growth, the changing economy, and transportation were used to describe the geography of the area at different dates and also to measure its regionality.

Originally covered with a dense coniferous forest, the area fronts upon Willapa Bay, the first embayment north of the estuary of the Columbia River. Repelled by the forest, the first pioneers settled on the limited area of prairie-covered tidelands bordering on the Bay and gained their livelihood from that body of water. A second wave of settlement began in 1890, when railroads and the lumbering industry entered the area. Soon after, the settlements in the largest river valley gained ascendancy over the bay communities. Between 1920 and 1945 the rate of increase of the population and the rate of the development of the economy declined in tempo, and in 1945 a period began during which it appears that the area's population numbers and economy will become reasonably stable. The main industries of the region--oyster farming, agriculture, lumbering, tourism, and fishing--were all present by 1890. In 1955 the economy was still dependent on local resources, but the marketing of the products and the life of the inhabitants were much more involved in the activities of the larger regions of the Pacific Coast and the nation.

This area did not begin to acquire regional identity until white, fixed settlement began in 1850. By 1890, an assembly of phenomena, both physical and cultural, had persisted in the same area relatively undisturbed for a sufficiently long period of time so that the Willapa Bay area and its environs were definitely established as a distinct geographic region. This was the high point of regional cohesiveness; thereafter it declined until by 1955 the only vestiges of such unity were the county organization and a few economic and social activities. The chief unifying influences had been water transportation, commonality of economic and social interests, and a degree of isolation from other areas. The disrupting influences were the rise of railroad and highway transportation, better outside communication, and the entrance of the lumbering industry and outside capital. In 1955, changes in the economic activities, transportation, population and settlements, and technologic developments had disrupted the region internally and nearly destroyed it as a separate entity.

365 pages. \$4.70. Mic 56-3389

**GEOGRAPHY OF MINERAL PRODUCTION  
AND MANUFACTURING IN CHOTA NAGPUR,  
THE HEAVY INDUSTRIAL AREA OF INDIA**

(Publication No. 17,962)

Pradyumna Prasad Karan, Ph.D.  
Indiana University, 1956

Supervisor: Norman J. G. Pounds

Chota Nagpur is unique among the industrial areas of Asia because only here the development of mining and manufacturing has so changed the economic geography that where only half a century ago roamed a handful of tribes, there is now a vigorously growing mining and manufacturing activity. In few other parts of the Oriental World has the influence of mining and manufacturing been so forceful as to change a not too hospitable humid region into a national center of mineral production and manufacturing.

The importance of Chota Nagpur is reflected in the fact that it produces more than 75 percent of the world's high quality mica, 51 percent of the world's lac, all of India's copper, kyanite, and nearly 90 percent of coal, iron and steel. It yields 50 to 80 percent of the total national output of several other minerals, and employs nearly 74 percent of the labor engaged in mining in India. In terms of employment six industries dominate Chota Nagpur: 1) primary metal production - iron and steel, copper and aluminum, 2) metal fabricating and engineering, 3) mica processing, 4) coke by-products, and fertilizers, 5) cement, ceramics and refractories, and 6) lac and shellac. This manufacturing and mineral industry is concentrated in seven areas: Damodar valley, Jamshedpur, Kodarma, Giridih, Son valley, Mushabani-Maubhandar, and Singhbhum-Mayurbhanj regions.

Mining and manufacturing regions are outlined on the basis of employment and other factors; their intensity of concentration is measured, and the areal and functional relationships between mining and manufacturing and a variety of environmental conditions are analyzed. Relationships are sought not only with the natural environment, but also with such elements as water supply, power, and availability of labor. The relationship between each region under investigation and the nation, and in some cases, with the world are studied. The flow of materials from mines and factories to markets is indicated. The contribution of mining and manufacturing to regional and national development is examined. Finally the potentiality of Chota Nagpur in manufacturing and mineral production, at the onset of the rapid industrialization under the Indian five-year plans, is evaluated.

The mineral-producing regions are examined mainly from the point of view of their evolution. It emphasizes the geographical factors in their exploitation, analyzes the shifts in the pattern of mineral production within individual regions, and includes the study of settlements, transportation pattern, and social problems of the mining regions. The distribution of manufacturing is quantitatively measured by use of data on labor. The factors in localization and development of manufacturing in specific regions are evaluated. The study reveals a significant inter-relationship between mineral and manufacturing regions; transport is welding them into one major industrial area of Asia. If the development is well planned and

efficiently carried out, Chota Nagpur may become an industrial district of world importance.

313 pages. \$4.05. Mic 56-3390

#### THE REGIONALIZATION OF BUTTER AND CHEESE PRODUCTION IN WISCONSIN

(Publication No. 17,323)

Gordon Rowland Lewthwaite, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Clarence W. Olmstead

Wisconsin cheese production is concentrated in well-defined regions in the southwest, east, center and northwest, while butter production characterizes the west. To test the many explanations offered, this problem of regionalization has been examined within its broad historical setting, but analysis has been integrated around maps of past and present distributions and potentially related factors, especially the character of dairying, which research suggested as basic.

Butter was a ubiquitous farm product about 1870, but cheese production, favored by technology and marketing, burgeoned in the south and east as dairying intensified. Environmental selection was less significant than economic pressures and the response of individual Swiss in Green and Dodge counties, and easterners--especially New Yorkers--in Richland, Sheboygan and southeastern counties, though Kenosha formed an extension of the Illinois cheese region.

Before 1900, the pattern shifted as butter-manufacturing and marketing improved. The southeast evolved through the lucrative but damaging phases of cheese-skimming and filling towards butter specialization --a trend furthered by affiliation with the Elgin butter market, dairying in winter when butter was favored by prices, and, usually, admixture with Corn Belt farming. In western Wisconsin butter predominance reflected the period of development, Scandinavian settlement, Minnesotan influence, the cooperative movement and the adaptability of creameries to dairying of moderate intensity and mixed character.

Elsewhere cheesemaking spread from established nuclei. In the southwest, foreign cheese production was sustained by immigration, social cohesion and expanding markets, American cheese by vigorous reform. Although boundary coincidence was incomplete, terrain and possibly climate limited corn production and supported specialized summer dairying. In Dodge county, dairy-intensity favored but did not define the cheese region which expanded because Limburger and the locally-developed specialty, Brick cheese, fitted with winter dairying and secured an exceptional market. In Sheboygan county small factories, leadership, financial support and favorable transportation and marketing stimulated a rapid growth unchecked by skimming and filling. Technical backwardness was counterbalanced by coolness and humidity and the intensive, specialized summer dairying consequent upon a German population, small farms, and, especially, edaphic and climatic conditions.

The early decades of the century witnessed the

westward extension of cheese manufacture, assisted by reviving prosperity, leadership which unanimously urged cheese specialization as the logical response to climatic advantages, local enterprise and immigration from crowding cheese territory--Americans and Germans occupying the Shawano and central regions, Swiss moving into the northwest. Local choice rather than agricultural transitions determined boundaries in the northwest, but farm-economy was elsewhere decisive. Gathered-creameries occupied the sparsely-farmed sands and cutover, and cheese specialization developed where soils and climate favored pasture and dairy emphasis.

Causes therefore varied with time and place. Ethnic stock, initial choice, reputation and inertia were effective especially where agriculture was indecisive. Cheese production was originally sensitive to natural conditions. But more significant were economic and environmental factors which produced the most critical causal relationship--the degree of intensity and specialization of dairying. For cheese represented the higher use-value, especially in summer, and frequent delivery of whole milk for cheese-making was practicable and profitable where milk cows were numerous. But where intensity diminished or grain-corn, hogs and beef cattle were important, fresh-milk hauling became inconvenient and lost financial significance, and skim and buttermilk (rather than whey) were valued for stock feeding--thus favoring butter rather than cheese production.

Recent developments have modified these controls in Wisconsin. Market and condensed milk have replaced creameries in the southeast, creating a late conformity with theories of concentric zonation around markets. Multiple-operation and butter-and-powder plants, using whole milk efficiently, have generally prevented the retreat of a depressed butter industry before prospering cheese manufacture except in the southwest. Inertia and institutional development have thus consolidated a pattern originally developed in conformity with the agricultural complex.

590 pages. \$7.50. Mic 56-3391

#### THE ROLE OF ECONOMIC-GEOGRAPHIC FACTORS IN THE DESTINY OF RHODES

(Publication No. 18,823)

Paul Peter Vouras, Ph.D.  
The Ohio State University, 1956

##### Purpose:

The purpose of the study was to determine from an economic-geographic viewpoint the logical disposition of the island of Rhodes. Under the treaty of Lausanne (1923), Rhodes was transferred from Turkey, an agrarian nation, to Italy, a semi-industrial nation. In 1947, sovereignty of the island was again shifted, this time to Greece, a semi-agrarian nation, on the principle of self-determination. In both transfers the decisions of the statesmen were based mainly on non-geographic factors.

##### Procedure:

In the investigation, we consider, first, the actual

development of the resources of the island under the Ottoman Empire, Italy, and Greece respectively. Second, the results of the economic policies of each of the governing nations are reviewed. Third, in the light of economic-geographic circumstances an attempt is made to determine what the logical status of Rhodes should be: (1) continued affiliation with Greece; (2) a return to Italian or Turkish rule; (3) conversion to an independent state.

#### Results:

The economic development of the resources of Rhodes was directly or indirectly subsidized by each of the governing nations. External assistance was needed because Rhodes' natural resources were inadequate to support its population.

Unlike Italy and Greece, Turkey did not actively engage in the economic development of the island. The Rhodians had to depend upon their own initiative. Nevertheless, the tempo of economic improvement was dependent upon the indirect economic concessions granted by the Sultan.

Both Greece and Italy, largely for their own advantage, carried out remedial measures to solve the problems that retarded the development of the agricultural, industrial, and commercial sectors. Despite the limited progress made, the people of the island still had to depend on Turkey to meet their food requirements.

Italy's economic program did not bring about the desired results because it was retarded by indifference and dislike among the peasants for the measures imposed upon them. On the other hand, the Greek program received greater Rhodian support.

#### Conclusions:

Rhodes could succeed in maintaining an independent national existence only by lowering its present standards of living. Consequently, it appears that if Rhodes wishes to maintain and improve its current standard of living, it must attach itself economically to the mainland of Asia Minor, which can supply the required food and raw materials.

Italy is no longer interested in possessing Rhodes because the recent political developments in the Middle East have made the island strategically as well as politically unimportant in the Eastern Mediterranean. Since the Middle East is no longer an attractive colonial area for European powers, it is doubtful that Italy would want to continue to support Rhodian economy when there is no prospect of economic gain. It is equally true that neither Turkey nor Greece has the capacity or the enthusiasm to assist the Rhodians in advancing their agricultural or industrial development within the island itself. In the light of the circumstances, just what the best permanent status of Rhodes would be presents an almost insoluble problem. If we consider the socio-cultural elements alone, then it seems that the attachment of Rhodes to Greece would be logical. From the economic viewpoint, however, Rhodes apparently would fare best as a part of the Turkish mainland. It is evident, thus, that there must be an ultimate resolution of the political, economic, and social inclinations of the people if they are to establish themselves upon a stable basis. The prospect of this action does not appear bright for the immediate future.

183 pages. \$2.40. Mic 56-3392

#### A GEOGRAPHY OF THE NEW ZEALAND GOVERNMENT RAILWAYS

(Publication No. 17,347)

William Huston Wallace, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Richard Hartshorne

This dissertation is a geography of the New Zealand Government Railways. Its purpose is to examine the role of railways in the Geography of New Zealand.

Part I of the paper is a discussion of the railway pattern in relation to the patterns of landforms, population, and economic activity.

New Zealand is a rugged country but, due to the localization of human activity, most of its railways are located in areas of gentle terrain. Within broad limits imposed by landforms, it is construction standards that determine railway alignment.

Although large sections of New Zealand are very far from railways, the dominion's population is really very well served by the railnet. Over ninety per cent of all New Zealanders live within ten miles, by road, of railway stations.

The economic activities of New Zealand are also well served by railways. The more intensive types of agriculture and large-scale extractive activities are particularly well covered by the railnet. All of the country's major trade centers and principal ports have good rail connections; indeed, New Zealand's principal rail centers are also its primary ports and commercial foci.

Part II is an analysis of various types of traffic at stations on all parts of the system and it also reveals the major flows of passengers and goods over the railways.

The pattern of livestock traffic reveals the basic features of New Zealand's animal husbandry. Shipments of store stock from extensive pastoral zones and larger numbers of fattened stock loaded at points in more intensively farmed districts are the dominant features of outward livestock traffic. The amount of activity at the various freezing works is revealed by the animal receipts and frozen meat shipments at these points.

Traffic from limeworks and chemical fertilizer plants to farming districts gives a further indication of the character and intensity of agriculture in various parts of New Zealand.

Timber traffic reveals the significance of urban markets, where large-scale construction takes place, as the terminal points of shipments from the major extracting areas of each island. The analysis of coal traffic indicates New Zealand's major producing areas: the Waikato Field on the North Island, the Westland Fields and the Ohai Field on the South Island.

To passenger traffic the contributions of a few depots -- those in the large cities, particularly where suburban service is provided, and those on main lines -- are outstanding. The significance of the "quality of service," and the characteristics of the population as well as the distribution of population are evident throughout the system.

In Part III the density of traffic on various parts of the system is analyzed.

The New Zealand Railways consist of three physically separate units: the North Island Lines, the South Island Lines, and the Nelson Line. Within each of the two large

island systems there are major functional divisions which focus upon the two principal cities. These four divisions -- the Auckland System, the Wellington System, the Christ-church System, and the Dunedin System -- are the major functional units of the New Zealand Railways.

Traffic densities are generally heavier on the North Island than they are on the South Island; in fact, the average density of the North Island Lines is more than twice

that of the South Island Lines. Indeed, over the North Island Main Trunk Line moves a traffic which is equal to 125 per cent that handled by the entire South Island system.

Traffic on individual lines reflects the intensity of human activity adjacent to the railway and, on main lines, the movements of goods and people to and from major centers or between regions.

429 pages. \$5.50. Mic 56-3393

## GEOLOGY

### STRUCTURAL GEOLOGY AND STRATIGRAPHY OF THE FRA CRISTOBAL QUADRANGLE, SIERRA COUNTY, NEW MEXICO

(Publication No. 17,049)

Eugene George Cserna, Ph.D.  
Columbia University, 1956

The southwest corner of the Fra Cristobal Quadrangle is about 8 miles north of Truth or Consequences (formerly Hot Springs) in south-central New Mexico. The central part of the quadrangle is occupied by the Fra Cristobal Range which trends approximately north.

Pre-Cambrian, Cambrian, Ordovician, Pennsylvanian, Permian, Cretaceous, Tertiary, and Quaternary rocks are exposed within the area with recent rocks forming the valley fill east and west of the mountains.

The Fra Cristobal block is essentially a horst, bounded on the east and west by high-angle normal faults. Structurally it consists of four distinct broad folds which, from north to south, are the Fra Cristobal anticline, Fra Cristobal syncline, Engle anticline, and Engle syncline. Each structural subdivision is cut by numerous, high-angle, normal and reverse faults. Stratigraphic and structural evidence indicates that different types of deformation affected the block at different times. Folding and associated thrusting took place sometime after the early Tertiary, possibly in late Laramian time. Faulting appears to have followed the folding. It is believed to have taken place intermittently from early Tertiary times to the present.

Evidence of strong lateral compressional stresses and resulting plastic deformation is present along the west side of the mountains, in a narrow belt, where Pre-Cambrian granite and Lower Paleozoic rocks were intensely folded and overturned. In the same belt the gypsiferous (Permian) Yeso beds present abundant, and very good illustrations of injective folding.

Normal and reverse faulting cuts preexisting structures and occurs throughout the range. Maximum vertical displacement is seen in the extreme northeastern and northwestern part of the mountains, where the throw is estimated to exceed 5000 feet. In general, vertical displacement along the faults is variable and ranges from a few tens of feet to over 5000 feet, the typical throw about 300 feet. The fact that the extremely mobile gypsiferous Yeso beds are cut in many places by numerous faults without any tendency to be otherwise disturbed indicates

that faulting was the result of essentially horizontal tensional stresses within the crust.

Most of the fault traces trend N. 35-45° W. and are essentially parallel with the dominant joint direction in the area. Fracture patterns and associated tension gashes suggest that the dominant joint set is the result of a horizontal couple acting eastward to the north and westward to the south, the maximum strain axis trending N. 40-50° E., minimum strain axis N. 35-45° W., and intermediate axis perpendicular and at right angles to the other two. It is believed that horizontal tensional stresses, acting essentially in an east-west direction at a later date, utilized the preexisting strongly jointed areas as loci of deformation. These stresses may have originated in consequence of broad regional upwarping along an axis trending north.

Regional evidence indicates that the Fra Cristobal Range and its southern continuation, the Sierra Caballo, are the remaining east side of a disjointed major Laramide uplift, comparable in size to the Big Horn Mountains. The local thrusting and folding, described in the main part of this paper are characteristic features of such uplifts but difficult to comprehend as parts of narrow fault blocks such as we see today. 119 pages. \$1.50. Mic 56-3394

### SURFICIAL GEOLOGY OF THE HORNE LAKE AND PARKSVILLE MAP-AREAS, VANCOUVER ISLAND, BRITISH COLUMBIA

(Publication No. 18,792)

John Gladstone Fyles, Ph.D.  
The Ohio State University, 1956

The report is concerned with the unconsolidated deposits and physiographic features of part of the eastern coastal lowland of Vancouver Island and adjoining mountains and valleys. The coastal lowland lies along the southwest edge of the structural basin known as the Georgia depression.

The main surficial materials of the area comprise two groups of glacial deposits, a thick intervening succession of non-glacial deposits, and a wide variety of post-glacial deposits. The lower glacial deposits, called the Dashwood group, consist of till and glaciomarine stony clay. The succeeding Quadra group consists of peat-bearing silts

and gravels of marine-shore and fluvial origin overlain by thick white fluvial (?) sands. Peat from the basal beds of this group has a radiocarbon age of more than 30,000 years. An erosion surface with relief of several hundred feet separates the Quadra group from the upper glacial deposits. These form the Vashon group and consist mainly of till, ice-contact gravel, and glaciomarine stony clay. Overlying the Vashon group are marine, fluvial, lacustrine, swamp, and colluvial deposits. The marine deposits are confined to the coastal lowland and the intermontane Alberni Valley.

The Dashwood group seems to record a regional pre-Wisconsin glacial invasion, possibly during the Illinoian age. During the succeeding deglaciation, the sea entered the Georgia depression and stood at least 250 feet above present sea level. Subsequent recession of the sea to at least its present level is recorded by the basal peaty beds of the Quadra group. The climate during deposition of the peaty beds was cooler than at present. The succeeding Quadra sands are thought to be a fluvial plain deposit that filled the north part of the Georgia depression to an altitude of at least 300 feet, probably during an interval of rising sea level. Much of the sand was removed again during an interval of fluvial erosion and, apparently, of

lower sea level. The non-glacial interval represented by the Quadra group and by this erosion may have been an interglacial equivalent to the Sangamon age.

The Vashon group and the glacial erosional features of the area were formed during a single major Wisconsin glaciation. At the climax of this glacial invasion, an ice sheet filled the Georgia depression and flowed south to southwest across the southern Vancouver Island mountains. As the ice surface dropped below the crest of the mountains, the ice sheet separated into a large, southeast-flowing glacier in the Georgia depression and a network of glacier remnants in the mountain valleys. Many of these valley glaciers were stagnant, but a few were active outlet glaciers of the glacial body in the Georgia depression. An active glacier in Alberni Valley was fed by an icecap on the mountains to the northwest. During deglaciation, the retreating glacier lobes in the Georgia depression and in Alberni Valley were bordered by marine water. The land has risen relative to the sea during the post-glacial interval, and now the highest marine deposits, formed while the glaciers were retreating, are 500 feet above sea level in the coastal lowland and 300 feet above sea level in the Alberni Valley.

283 pages. \$3.65. Mic 56-3395

## HEALTH SCIENCES

### HEALTH SCIENCES, PHARMACY

#### A STUDY OF MOLECULAR INTERACTIONS IN AQUEOUS SOLUTIONS OF CERTAIN PHARMACEUTICALS

(Publication No. 18,401)

David Emanuel Guttman, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Takeru Higuchi

This study was concerned with the extent and nature of molecular associations occurring in aqueous solutions of certain pharmaceuticals. A more fundamental understanding of this phenomenon seemed desirable since limited past studies suggested that the in vitro and in vivo behaviors of pharmaceuticals may be modified by interactions of this nature. In this investigation the elucidation of a number of systems was attempted. Particular attention was paid to the interactions of some polyethers and a polyamide with phenol, to the complex formation occurring between iodine and polyethylene glycol, to the reversible associations of some substituted xanthines in aqueous solution, to the interaction of caffeine with p-acetaminophenol, and to the effect of 1-ethyltheobromine on the hydrolytic breakdown of benzocaine. Phase studies involving solubility and partitioning behavior were used in most cases to detect and determine the nature of these interactions.

The investigation of the complexing reaction between polyethylene glycol and iodine in an iodine-potassium iodide aqueous system showed that at high tri-iodide ion concentrations and low free iodine concentrations an insoluble complex involving the glycol and potassium tri-iodide was formed. At much higher free iodine concentrations a second insoluble complex containing a considerable amount of iodine per se was reversibly formed from the first. The concentration dependencies of both complexing interactions on iodine, iodide, and potassium ion were determined. The approximate overall stoichiometries of the complexes were established.

The interaction of phenol with polyethylene glycol, polypropylene glycol and polyvinylpyrrolidone was studied by a photometric titration technique. The influences on the complexing tendency of salt concentration, alcohol concentration and temperature suggested that a competition existed between phenol and water for the polar groupings on the polymer chain. A dialytic study was utilized to gain a further insight into the interaction of phenol with polyvinylpyrrolidone.

Experimental studies involving partitioning between two solvents suggested that caffeine underwent marked association in aqueous solution. A graphical method of analyzing the experimental results indicated that caffeine existed in aqueous solution primarily in monomeric, dimeric and tetrameric forms. Other 1,3,7-trisubstituted xanthines exhibited similar behavior. The centers primarily involved in the formation of both dimeric and tetrameric species appeared to be located in the pyrimidine-dione ring of the xanthine nucleus.

The extent of complex formation between caffeine and p-acetaminophenol was determined by studying the effect of the phenol on the partitioning of caffeine between water and an organic solvent. The results indicated that at least three simultaneous equilibria were involved in the formation of water soluble complexes.

A synthetic caffeine homologue, 1-ethyltheobromine, was shown by a solubility study to complex with benzocaine. The results of a kinetic study showed that 1-ethyltheobromine was effective in decreasing the rate of hydrolytic breakdown of benzocaine through complex formation.

The systems encountered in this investigation illustrated two broad general classes of molecular interactions: 1) those which result in phase separations and 2) those which occur without visible manifestations. The latter class especially is generally overlooked in the formulation of pharmaceutical preparations. A recognition and understanding of this phenomenon is of definite importance in the scientific development of multicomponent pharmaceutical dosage forms since the physical, chemical and even therapeutic properties of many medicinals may be significantly modified by associations of this nature.

144 pages. \$1.90. Mic 56-3396

## HISTORY

### HISTORY, GENERAL

#### CHARLES P. NEILL AND THE UNITED STATES BUREAU OF LABOR: A STUDY IN PROGRESSIVE ECONOMICS, SOCIAL WORK AND PUBLIC ADMINISTRATION

(Publication No. 17,751)

Richard G. Balfe, Ph.D.  
University of Notre Dame, 1956

This dissertation is a study of an investigating agency, the Bureau of Labor, and the head of that agency, Charles P. Neill, during the years 1905 to 1913. Through the progressive influence of Neill, the Bureau of Labor changed into an executive department of the government. This transition in the function of the Bureau of Labor took place during Neill's incumbency. The start of the transition from a simple investigating agency to an executive agency came when the Roosevelt Administration placed Neill and the Bureau of Labor in the middle of the meat packing controversy in 1906. The results of the Bureau's investigation proved to be a resourceful weapon against trusts and a useful instrument to advance labor's interest. Because of the excellent work done by Neill and the Bureau of Labor in this controversy, the Roosevelt Administration placed more and more executive duties upon the Bureau of Labor.

The President turned over to Neill and the Bureau of Labor for their investigation all violations of the eight hour day law. After Neill's investigation disclosed that the various departments of the government differed in their interpretation of the eight hour day law, he insisted that the Attorney General make concrete rulings in each instance. Moreover, the President turned over to Neill and the Bureau of Labor for their investigation all violations of the contract labor provisions of the immigration laws. The Bureau conducted investigations into State Immigration Bureaus (particularly the newly created Department of Immigration formed by the State of South Carolina), the McKee's Rock strike in which newly arrived immigrants were involved, and many isolated complaints made by the leaders of the American Federation of Labor.

Investigations by the Bureau of Labor resulted in more and more social legislation. In both meat packing and child labor legislation the Roosevelt Administration had to support or to oppose the measures. In both instances Neill made recommendations. Since the Bureau of Labor and Neill had influence on the policies of the administration, bitter partisan politicians began to oppose the administration by opposing the policies and practices of Neill and the Bureau of Labor. The meat inspection bill and the Parsons-Beveridge child labor bill resulted in bitter denunciation of the Bureau of Labor and Neill.

Another progressive Roosevelt policy was to make use of existing laws. Neill was the first to use the mediation and arbitration provisions of the Erdman law. From 1898

to 1907, nine years, the Commissioner of Labor made only one attempt to use the law. From 1907 to 1913, only six years, Neill used the Erdman law sixty times.

Two chapters in the dissertation are on Neill's education and his work in organized charity. These chapters show that Neill was a progressive in other activities. He was influenced by a group of economists at Johns Hopkins who were pragmatic, yet Christian, and more sympathetic to state intervention in the economic process. In charity work, Neill was one of the first volunteer charity workers to advocate the use of trained professional workers.

243 pages. \$3.15. Mic 56-3397

### HISTORY, MEDIEVAL

#### THE JEWS AND THE CONSTITUTIONAL STRUGGLE IN THE THIRTEENTH CENTURY CROWNS OF ARAGON

(Publication No. 19,140)

Jerome Lee Shneidman, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Gaines Post

The century between 1220 and 1327 witnessed the dramatic expansion of the Aragonese state. From a minor power, whose chief attention seemed to be directed toward the feudal conflict in northern France, Aragon became a major military and naval power with interests throughout the Mediterranean.

This sudden expansion both revolutionized the general Mediterranean power complex and upset the internal structure of the Aragonese state.

The purpose of the dissertation is to explore one of the results of this change; the attempt of the Kings to circumvent the limitations placed on their prerogative by the nobility and the burghers. The purpose, moreover, is to study the monarch's utilization of the Jew as a royal official to execute his will.

The dissertation first examines the constitutional structure within the three Hispanic states of the Aragonese Crown: the Kingdoms of Aragon and Valencia, and the County of Catalonia. Particular attention is paid to the means by which the feudal constitutional organizations attempted to limit the monarch's power. Mention is also made of the various political theories which either supported or opposed limitations on the king's prerogative. Social attention is granted to Spanish political theorists.

Chapter three recounts the relations of the Jews within the States of Aragon with their Christian governors. Particular attention is paid to the edicts and laws - both

secular and temporal - which limited the freedom of the Jews. Having demonstrated the legal limitations placed upon Jewish freedom, the dissertation examines the methods by which the Aragonese kings removed virtually all such restrictions.

The last three chapters of the dissertation examine the rôle of the Jews as royal officials, especially as the royal bailiffs. The argument that the Jews received the position of bailiff as a result of lending the monarch money is discussed and refuted.

The conclusions reached by the author are as follows: The Aragonese monarch finding himself restricted in the freedom of his actions by the constitutional structure set up by the nobility and the burghers attempted to construct an extra-constitutional administrative system free from all feudal control. The king's attempt to establish such a system was contingent upon the utilization of individuals outside of the feudal system. The only peoples who were, by law, outside the feudal organization - since by law they were considered as royal slaves - were the Muslims and the Jews. The monarch did attempt to utilize his Muslim subjects, but the wars of the "Reconquest" made this impossible. The Jews were the only people, therefore, who were entirely dependent upon the monarch's good favor and who, moreover, could be trusted to execute the royal command. Particular attention is given to the years 1265-1283, when the bailiff of virtually every important city within the States of Aragon was a Jew.

The result of this administrative system, independent of feudal control, was the virtual political independence of the king.

This royal freedom culminated in the "War of the Sicilian Vespers," which was begun by King Pedro, not only without the permission of the feudal authorities but without their knowledge. When the war brought about an invasion of Catalonia, the Aragonese nobility refused to defend the crown, claiming that the monarch had not their permission for the war and that the war was, therefore, none of their concern. To secure the support of the Catalan nobles, and finally to force the Aragonese to come to the aid of the realm, the monarch was forced to abandon his extra-constitutional system and leave the government of the state entirely in the hands of the feudal authorities.

In three appendices the author lists the names and dates of those officials who served the crown. Indication is also given as to where these officials served. The third appendix lists the taxes which the Jewish citizens paid to the crown.

Throughout the work the author depends upon the Registers of the Aragonese crown, printed records of the meetings of the various Cortes of the Aragonese Crowns, published excerpts from the Archives of Zaragoza and Montpellier and various secondary sources.

Since there is no general bibliography for the subject discussed in the dissertation, the author has compiled an all inclusive bibliography covering thirteenth century Aragonese history. 209 pages. \$2.75. Mic 56-3398

## HISTORY, MODERN

### THE USE OF SOCIAL SCIENCE IN AMERICAN INDUSTRY, 1910-1955: A HISTORICAL ANALYSIS

(Publication No. 19,068)

Loren Baritz, Ph.D.

The University of Wisconsin, 1956

Supervisor: Professor Merle E. Curti

Understanding the uses to which various institutions put knowledge is an important obligation of the historian. Usually, however, historians have neglected this area of research. This study focuses on the use one important institution, industry, has made of one branch of knowledge, social science. Only psychology, sociology, and anthropology are discussed because the main concern of this study is on the personnel problems of industry.

The research procedure for this study consisted of several parts. Interviews were held with many industrial social scientists as well as managers who have hired them. Several contacts were made with specific companies and their records used. The library research consisted mainly of the industrial trade press, parts of the labor press, professional social science journals, textbooks in the industrial social sciences, personnel administration, and business administration. Private correspondence with labor officials and managers also was used.

In the twentieth century, because of the increasing complexity of all phases of American life, the industrialist has the need, but neither the competence nor time to become proficient in the social sciences. Though industrialists traditionally have been suspicious of social scientists, several factors encouraged them to begin using the services of those experts. The scientific management movement, the use of psychology in advertising, and the success of the psychological testing program during World War I helped managers overcome their skepticism of social science.

In 1913 psychologist Hugo Münsterberg formulated the first systematic outline of industrial psychology. During World War I and throughout the 1920's psychologists were asked by managers to apply their testing techniques to the selection problems of industry. Though over-enthusiasm and psychological quacks hindered the movement somewhat, psychological testing became an established part of the industrial scene.

In the late 1920's a long series of experiments was started at the Hawthorne Works of the Western Electric Company. This was the most important social science experiment ever to be conducted in industry. The effects of this experiment permanently modified the course, not only of industrial social science, but of all research concerned with human conduct. This was also the start of industrial sociology as a distinct discipline.

During the depression and throughout the 1940's, psychologists and sociologists devised many techniques and concepts useful in industry. Chief among these were attitude surveys, counseling, formal training programs, morale studies, motivation studies, and techniques of leadership. The successful use of social scientists by the government during the second World War greatly reduced the persistent managerial suspicion of social science.

After World War II, the interdisciplinary human relations approach to industrial problems was launched. Focusing on the interrelationships between the individual and his environment, this approach borrowed something from each of the industrial social sciences. Using techniques like sociometry and role playing, the human relations specialists were welcomed by managers.

Because the great majority of industrial social scientists shared the assumptions of America's business leaders, because they made their research results available to managers, the implications of the work of the social scientists are not in the interests of labor. Over the years, social scientists have made much progress in their search for ways of controlling human conduct. There is a danger that their science will be used mainly for strengthening the power of the industrial elite.

447 pages. \$5.70. Mic 56-3399

#### INDIANA'S CIVILIAN SOLDIERS

(Publication No. 17,934)

Calvin C. Berlin, Ph.D.  
Indiana University, 1956

Chairman: Lynn W. Turner

This study is primarily an administrative history, treating in a chronological manner the progress of Indiana's World War II "homefront" defense program, which was begun under the guidance of the Governor's Emergency Defense Council in May, 1940, and continued to mid-1945 by the Indiana State Defense Council. The State Defense Council is a collective term used to designate the organization created by the Indiana General Assembly in March, 1941, to handle civilian defense and other war-created problems that could not be effectively handled by regular agencies of government. It was composed of a State Director and his staff, with offices in Indianapolis; an Advisory Defense Council; and an Administrative Defense Council. The State Defense Council co-ordinated the activities of 92 county defense councils and some 250 city and town defense councils, and co-operated with various emergency committees whose activities were the joint responsibility of the State Defense Council and regular state departments.

Prior to Pearl Harbor, the Indiana Defense program was primarily designed to assist in industrial development; helping industry to lay the groundwork for expansion and conversion to meet the demands of national defense. Hence, aid was given to war boom towns and a Bi-Racial Plan to help Negroes find employment on a basis of equality with other citizens was inaugurated. After the United States entered the war, the State Defense Council, working in co-operation with the national Office of Civilian Defense, initiated measures to protect the state from possible air attack or other enemy action. While this phase of the civilian defense program was maturing, the final phase was under way. This was the civilian war service program, which embraced a myriad of non-protective activities: scrap collecting, child care for the children of parents engaged in war work, nutrition and physical fitness programs, and many other activities designed to help morale

and aid the total war effort. The state's civilian defense organization also aided the Federal Government in setting up the organizational machinery needed to carry out the rationing program and gave assistance to the Treasury Department in conducting war loan drives in the state.

This history also relates the many instances in which civilian defense groups went into action to cope with disasters occasioned by flood and fire, treating in detail the work performed during the 1943 floods and the services rendered by the Forest Fire Patrol. The organization, recruitment and activities of the State Guard and Indiana wing of the Civil Air Patrol are also related.

The conclusion reached in this study is that the State Defense Council — working in co-operation with federal, state, and local agencies, civic and fraternal organizations, and local civilian defense bodies — succeeded admirably in its task of organizing the resources of the state behind the national war effort. By-products of this effort were lessons learned concerning the value of community planning and the part that the civilian defense organization was able to play in alleviating natural disasters. Finally, many of the lessons learned during World War II might have some value in understanding the continuing problem of civilian defense.

This work was written under the auspices of the Indiana War History Commission, created by the joint resolution of the Advisory and Administrative Defense Councils on mandate of the 1943 Indiana General Assembly. The Commission, with offices on Indiana University's Bloomington campus, collected and preserved documentary evidence of Indiana's part in World War II. This collection, which included the official files of the State Defense Council, provided, along with various newspapers published in the state, the great bulk of the source material used in writing the dissertation.

279 pages. \$3.60. Mic 56-3400

#### THE EARL OF LEICESTER'S ADMINISTRATION OF THE NETHERLANDS, 1585-86

(Publication No. 19,080)

Gerald Francis De Jong, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Chester P. Higby

The earl of Leicester, representing Elizabeth I of England, arrived in the Netherlands at the head of some English troops in the winter of 1585. The Dutch leader, William the Silent, had been assassinated about a year earlier. The government was in a confused state of affairs. To add to the troubles of the Dutch, the Spanish troops under the able leadership of the duke of Parma were making rather rapid headway in reconquering much of the Low Countries. Thus, the majority of the Dutch people welcomed the appearance of Leicester in their country and looked upon him as a deliverer from their troubles. Shortly after the earl's arrival, the Dutch government gave him the title of governor-general and voted him rather extensive powers. The earl of Leicester, on his part, embarked upon his task with both enthusiasm and optimism. The hopes of Leicester and the Dutch leaders, however, were doomed to disappointment. After one year's stay in

the Netherlands, the earl returned to England without having accomplished very much. A number of factors account for this failure.

This dissertation represents an attempt to analyze those various factors in some detail. First of all, the earl's instructions from Elizabeth were difficult, if not impossible, to carry out. Closely allied with this, there is the fact that he was poorly supplied with money and troops by Elizabeth. Secondly, he was unacquainted with the party disputes in the Netherlands. Whereas William the Silent had always managed to follow a rather neutral policy as regards Dutch party politics, Leicester not only quickly found himself thoroughly enmeshed in the party struggle but was soon a leader of one of the parties. Thirdly, the centuries-old antipathy that existed between the provinces of Holland and Utrecht complicated things immensely for the earl. Fourthly, and perhaps most important, there was the fact that Leicester did not understand the importance of maintaining good relations with the regents of Holland and Zealand. These two provinces together contributed by far the major portion of the revenue that managed to find itself into the national treasury. It was a great mistake on Leicester's part when he thought he could govern the country without the cooperation of the regents of these two provinces. Finally, there was the ineptness of the earl himself. He possessed none of the qualities necessary for sound statesmanship. As a military leader, he was unfitted to oppose so distinguished a commander as the duke of Parma. By a series of rash decrees and governmental changes, and by the loss of several towns to the enemy, these facts became increasingly obvious and caused many of the Dutch leaders not only to lose faith in Leicester but to turn against him.

Undoubtedly, the most important result of Leicester's stay in the Netherlands was the impression it left upon the country's constitution. The various provincial and municipal governments of the Low Countries had always jealously guarded their special rights and privileges, and were averse to delegating authority to a central governing body. Leicester's conduct and that of his supporters served to strengthen this feeling. Although the earl returned to the Netherlands for a few months in the latter part of 1587, his second stay was no more successful than the first. So much resentment had been built up against the earl, that the opportunity to establish a strong, centralized government was lost. Instead, the loose, decentralized arrangement, which was to last for two centuries, took permanent form.

261 pages. \$3.40. Mic 56-3401

#### THE CAUSES AND THE GROWTH OF RAILROAD REGULATION IN WISCONSIN: 1848-1876

(Publication No. 18,395)

Frank Nelson Elliott, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Merle Curti

In 1874, the Wisconsin legislature passed the Potter Law, generally conceded to be the most stringent of the "Granger Acts." Why was the Potter Law passed at that time? Less than ten years before most Wisconsin citizens

had wanted railroads - not railroad regulation. The contemporary explanation for the passage of the Potter Law, and similar regulation in adjacent states, was that the Grangers had determined to put down monopoly and extortionate rates. This traditional interpretation still prevails. By 1874, however, the demand for some form of railroad regulation in Wisconsin was over two decades old and welled from an entire complex of causes that had varied in relative importance from year to year.

The shortage of funds with which to build railroads sired many of the problems that precipitated a demand for regulation. Wisconsin citizens wanted railroads even though they could not afford them. The farm mortgage system of financing construction was a novel solution to the railroads' financial dilemma but it failed and ruined thousands of farmers. Community aid to construction was frequently equally unfortunate - Watertown's plight became a state scandal. Federal land grants were at best a mixed blessing to both the people and the railroads of Wisconsin. The state was shocked when the LaCrosse road bribed most of the legislature to get the land grant in 1856 and tempers did not improve when the railroads dallied in earning their lands.

Railroad managers frequently took very narrow views of their responsibilities to the public. The amateur promoters who built most early Wisconsin railroads were not always honest or efficient. Financial failures were common and were often attributed to managerial malfeasance. Even after the Civil War, Wisconsin railroad managers were never quite forgiven for the misdeeds and indiscretions of their amateur predecessors.

Wisconsin railroads were never quite able to live up to their advance billing. The state's rail network was not as well constructed or equipped as many people thought that it should or would be. Railroads had been advertised as the panacea for the transportation problem when they were only a partial cure. The cost of transportation remained high. Efforts to regulate high and discriminatory rates were an important issue in Wisconsin politics almost continuously from the Civil War until 1876. Interference with state politics, indifference to public wants in locating bridges and other facilities, the slaughter of animals, inconvenient scheduling and many minor failings were vexing. Dissatisfaction with many little things, added to resentment of a few major failings, resulted in a climate of opinion that by 1874 was definitely favorable to railroad regulation.

Wisconsin railroads would probably have been regulated in the 1870's regardless of whether or not there was a Grange. A railroad problem was inevitable until the rights, responsibilities and capabilities of railroads were clearly established. The demand for regulation was long standing. The political upset of 1873 that put the Reform Party in power was the result of many factors besides the mobilization of discontented farmers into the Grange. Furthermore, although the Potter Law may, as some alleged, have been a political trick designed to prevent railroad regulation, it did meet long felt needs. The law was repealed in 1876 because it was recognized as too stringent. The Vance Act, although much more moderate on the rate question than the Potter Law, retained many of the regulatory features that had been demanded for years.

338 pages. \$4.35. Mic 56-3402

**THE CHINESE IN THE PHILIPPINES DURING  
THE AMERICAN REGIME: 1898-1946**

(Publication No. 19,099)

Khin Khin Myint Jensen, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor Eugene Boardman

The Chinese in the Philippines constitute the largest group of non-Philippine citizens, the ratio being about one Chinese to one hundred and fifty Filipinos. As in Spanish times so during the American occupation, the Chinese played an important role in the Philippine economy; as late as 1947 they controlled about 37% of the Philippine trade.

Any alien group having such a large share of a country's trade naturally arouses the resentment of the native population. The purpose of this study is to investigate the problems concerning the Chinese community during the American rule. These problems are age-old ones. During the Spanish rule, the Chinese suffered periodic persecutions, could live only in certain restricted areas, and were tolerated because of economic necessity. American authorities, however, were considerably lenient toward the Chinese who now extended their activities into every sphere of Philippine business, thus becoming the dominant factor in the retail trade.

Three major questions confronted the American administration in their relations with the Chinese community. One was the immigration problem. The Chinese Exclusion laws of the United States were extended to the Philippines to prevent mass immigration of the Chinese. Despite this law, illicit Chinese immigration was a constant problem. A new immigration law promulgated in 1940 gave the Chinese a flat quota of 500 per year, but the Japanese war interrupted the smooth operation of this law.

The importation of Chinese laborers was the second major issue. During Spanish rule the Chinese were admitted for unskilled labor and agriculture but during American administration, Chinese labor was opposed for fear that it would mean unnecessary competition for Filipino laborers.

The third major question concerned the Chinese role in the Philippine economy. This significant problem still looms large in the horizon of even the poorest Filipino. The Chinese have organized their own banks which enables them to finance numerous foreign and domestic enterprises. Chinese chambers of commerce provide a means of action in business and civic affairs. These opportunities came only with American rule.

Certain political, social, and cultural factors affecting the Chinese have also been examined. A description of their role in the Philippines during the Japanese war has been included to show that in time of adversity, Filipinos and Chinese did co-operate. A brief epilogue highlights the present problems confronting the Chinese community.

One of the major conclusions reached by this study is that the Chinese benefited greatly in the transfer from Spanish to American rule. No longer were they subject to periodic persecutions; they could live and travel anywhere in the Islands, establish Chinese schools, and publish their own newspapers. Another conclusion is that the Chinese have greatly influenced Philippine civilization.

Although Chinese money and initiative has aided

Philippine economy and the two nationalities collaborated during the Japanese war, Filipinos still resent the role of the Chinese in their economy. Nationalization bills aimed at legislating the Chinese out of business have been introduced in the Philippine legislature. The situation requires delicate handling; only by patience, caution, and understanding can a permanent solution of the issues be reached.

Records of the Bureau of Insular Affairs in the National Archives and the United States Philippine Commission Reports are the chief sources for the major portion of this study. Mr. Chu Pei-chen's unpublished manuscript, "Chinese and the War in the Philippines," and the Fookien Times Yearbooks were also very helpful for information concerning the domestic life of the Chinese community in the Philippines. 415 pages. \$5.30. Mic 56-3403

**THE SCOTTISH HIGHLANDERS IN  
NORTH CAROLINA, 1733-1776**

(Publication No. 16,125)

Duane Gilbert Meyer, Ph.D.  
State University of Iowa, 1956

Chairman: Professor Charles Gibson

During the two decades preceding the American Revolution, the largest group of migrants from the British Isles to settle in America came from the Highlands of Scotland. They dispersed to several colonies but the greatest number chose the upper reaches of the Cape Fear River in North Carolina for their new home. Here they formed an agricultural settlement around the trading town of Cross Creek. At the outset of the Revolution, the Highlanders constituted the chief Loyalist faction in North Carolina. This work is designed to re-examine the Scottish Highlander settlement from its origins in 1733 to the Battle of Moore's Creek Bridge in 1776.

Special emphasis has been placed on three aspects of the topic. First, considerable attention is devoted to the background of this movement in order to correct widely held misconceptions as to the reasons for the migration and the time that it occurred. Second, the area and terms of settlement are revealed by use of evidence from land grant records and county recorder's books. Third, the complex problem of the Loyalist sympathies of the Highlanders is reviewed.

Historians have described an influx of Highlanders into North Carolina immediately following the unsuccessful rebellion of 1745, but colonial records fail to reveal such a migration. It has been asserted that many of the Highlanders were political refugees who were forced to take an oath to the King before departing for America. There is, however, no evidence to substantiate the statement. This investigation indicates that agricultural changes and population pressures coupled with an end of the clan system served to motivate the migration.

The Loyalist activities of the Highlanders cannot be explained on the basis of earlier oaths to the King, since few had taken such oaths. Economic self-interest, the influence of respected leaders, and a new feeling of friendship for the House of Hanover caused the North Carolina Highlanders to join the forces of George III.

297 pages. \$3.71. Mic 56-3404

RISE AND DEVELOPMENT OF ESTONIAN  
NATIONAL CONSCIOUSNESS, 1700-1905

(Publication No. 17,970)

Emanuel Nodel, Ph.D.  
Indiana University, 1956

After the end of the Great Northern War in 1721, the Estonian people went through great changes from an illiterate, enslaved peasant mass to a nationally conscious people at the beginning of the twentieth century.

The Northern War caused the economic and cultural ruin of the Estonian people for almost a century to follow. Though they became part of the Russian empire, they remained administratively, culturally and religiously under the hegemony of the Baltic German nobility. The latter continued to enjoy all their former privileges and oppressed the Estonians even more during the eighteenth century than in previous centuries, reducing them to serfs who could be bought and sold like cattle. At the beginning of the nineteenth century conditions began to improve as a result of the activities of the Estophils, liberal-minded Germans, who demanded the gradual abolishment of manorial labor. In the field of Estonian culture the Estophils gave stimulus to a cultural renaissance. Criticism by the Estophils and the resulting intervention of the Russian government in behalf of the peasants brought many reforms during the first half of the nineteenth century, abolishing manorial labor and opening the road to the formation of an Estonian land-owning peasant class. This period of transition (1800-1870) was full of hardship for Estonians. Nevertheless, they managed by their own hard labor and enthusiastic national leaders to reach cultural maturity by the end of the century. The majority of the people opposed the Russian government as well as the German Balts. They differed only as to ways of attaining political and cultural independence. This division began with Voldemar Jannsen, who advocated peaceful cooperation with the German Balts as well as with the Russian government. On the other hand Carl Robert Jakobson violently opposed pro-German attitudes: he preferred the help of the Russian government in fighting the latter.

During the close of the nineteenth century and the beginning of the twentieth the political chasm widened. Villem Reiman and Jaan Tonisson opposed both Germans and Russians, and believed in Estonian national unity regardless of class distinction. They were opposed by Konstantin Päts and also by the growing Social-Democratic Party, who believed in close cooperation with the Russian revolutionary movement. Though conditions had improved during the second half of the nineteenth century, the gravest problem, the shortage of land, still existed. Despite the land reforms, two-thirds of the peasantry were landless in 1905; the political and social privileges of the Baltic German minority still prevailed. The 1905 Revolution accelerated the growth of an Estonian national consciousness. The violence of workers and peasants during the turbulent 1905 revolution gave strong impetus to nationalist and social aspirations within the major Estonian political groups. The succeeding persecutions by the tsarist government and the active participation in those persecutions by the Baltic Germans increased the determination of the Estonian people to fight both with all their strength.

267 pages. \$3.45. Mic 56-3405

YOSHINO SAKUZŌ, 1878-1933: EXPONENT OF  
DEMOCRATIC IDEALS IN JAPAN

(Publication No. 17,734)

Walter Scott Perry, Ph.D.  
Stanford University, 1956

Yoshino Sakuzō, 1878-1933, was the foremost champion of democracy in Japan during his generation. From his earliest years a deep concern for the destiny of his country and an innate humanitarianism combined to produce his frame of thought which led him to the conclusion that democracy was the only fit answer to Japan's perplexities in a changing world. Specific elements of his thought were drawn from his Christian faith, his study of socialism and proletarian movements, and indigenous moral and ethical values. The original impetus of these factors was augmented by his firsthand observations of conditions in the contrasting environments of China and Europe, to which he added knowledge gained from omnivorous reading of political literature.

Yoshino became absorbed spontaneously in the study of politics and government while a student in the Faculty of Law at the Tokyo Imperial University, where he was attracted by the teaching of Onozuka Kiheiji, who was noted as a pioneer of liberal political thought in the early years of the present century. Yoshino himself, a few years later, was given a chair of modern political history in the same university, an event described as a watershed in the treatment of political studies in Japan.

His activity was not confined, however, to teaching and research. He was sponsor of the post-World War I student organization, the Shinjinkai; he wrote and spoke in opposition to ultranationalist and reactionary forces. He was engaged in varied humanitarian pursuits, including a much publicized project of rehabilitation following the earthquake of 1923. He was head of the YMCA in Tokyo for many years and managed a successful consumers' cooperative association. He finally turned to journalism as an occupation, devoting the last decade of his life to writing on political affairs and other momentous public questions. He was instrumental in advancing the universal suffrage movement and after its culmination in the universal manhood suffrage law, 1925, he stepped to the fore as an adviser and critic of the burgeoning proletarian political parties. He regarded the proletarian parties as the last hope for democratization in Japan, and, although he preferred to remain aloof from organized politics, he helped to organize the Shakai minshuto, believing that a new party dedicated to parliamentarianism was an indispensable requisite for strengthening and purifying Japanese political life.

Yoshino's concept of democracy differed in several important respects from the Western view, but he defined its ultimate ends in language paralleling that of many Western minds. He equated democracy with constitutional government; writing the Meiji Constitution, Japan had set itself on the road toward democratization. Democracy he believed was the élan of modern history giving efficacy to constitutionalism; democracy was the distillation of mankind's progress toward political morality and social justice. It was, moreover, the only form of government that could cope successfully with the peculiar problems of the modern environment evoked by the awakening of political consciousness and a sense of individual worth among the

hitherto inarticulate and inert masses. Yoshino predicated his argument on universal spiritual and moral values; he believed that regardless of polity the spirit of democracy could and should be supreme in the modern state. He sought to harmonize democracy with indigenous concepts of the state and moral, ethical and humanitarian values. In the sweep of world events, to which Japan was extremely sensitive, his views collided not only with traditionalism, but with new anti-democratic programs and ideologies as well, particularly with communism.

Yoshino's prolific writings provide superb insight into the intellectual, political and social history of the Taisho era.

497 pages. \$6.35. Mic 56-3406

#### THE RISE OF MAJOR LEAGUE BASEBALL TO 1891

(Publication No. 19,159)

Harold Seymour, Ph.D.  
Cornell University, 1956

Baseball stems directly from the English game of rounders, and was played by Americans in simple forms almost from the beginning. The first organized team was the New York Knickerbockers, a group of gentlemen, business and professional men who formed an amateur club in 1842 in New York City, where they played under rules which contained the fundamentals of modern baseball. Other amateur teams rapidly entered the field, including many composed of workingmen, whose participation gradually destroyed the aura of exclusiveness with which the Knickerbockers sought to surround the sport. These amateur clubs organized the National Association of Base Ball Players in 1857.

After the Civil War, which had retarded the spread of clubs, a tremendous growth of amateur teams occurred in the settled areas of the country. Mounting emphasis on outdoor exercise, the development of transportation--particularly the railroad, tours of famous clubs, and the excitement and inexpensiveness of the game itself contributed to its rapid acceptance. The character of the game as polite recreation and opportunity for social intercourse was soon changed as promoters, catering to the growing need of urban dwellers for amusement, began to commercialize the game by enclosing the ball fields and charging admission. The playing rules, too, were gradually refined to make the game more palatable to spectators, and the increased attention given the game in the press also stimulated interest.

Intensified rivalry between clubs and communities led to keen competition for players, who were offered sinecures and prizes and paid salaries surreptitiously. These practices ushered in a twilight period of undercover professionalism. In 1869 the Cincinnati Red Stockings, openly declaring themselves a wholly professional team, toured the country, defeating amateur clubs with ridiculous ease and proving beyond all doubt the superiority of professional players, who could devote full time to the game. Other clubs followed suit, and in 1871 the professionals formed their own National Association of Professional Base Ball Players.

However, the weak administration of the professional association was unable to cope with the growing evils of

gambling and selling games and with the heavy turnover among its clubs due to financial failure. In 1876 it was superseded by the present National League of Professional Base Ball Clubs, which separated the management of the game from the playing end of it, allotted only one club to a city, and protected the territorial rights of each. It also provided for disciplining its players, penalizing those guilty of dishonesty or violation of contracts with expulsion and the blacklist. However, it still faced a grim struggle for survival, inasmuch as club turnover from financial collapse continued heavy.

The owners concluded that, to make ends meet, competition among themselves for players with the consequent bidding-up of salaries had to be checked. In 1879 they agreed that each club could "reserve" five players for whom the other clubs would not bid. The number was gradually extended to include the entire team. In short, they restricted the free bargaining rights of their players so that they could not sell their services to the highest bidder, but must come to terms with the club reserving them. The immediate effect was to lower salaries; but as the business became more stabilized, salaries eventually increased, although not as rapidly as profits.

The owners of the newly-established baseball business were at once partners and competitors, and in other respects their business was unique in comparison with others; yet the subsequent history of professional baseball reflected the American economic scene in general. Seeking to preserve a monopoly, the National League fixed admission prices, boycotted recalcitrant clubs and leagues, resorted to the courts, and fought trade wars with rival organizations for control of territories and markets. The first of these wars occurred in 1882 when the American Association, operating on a new platform of cheaper baseball, Sunday games, and liquor-selling on the grounds challenged the National League's monopoly control of players and the territorial rights of some of its clubs. Peace came after a year of struggle as the two rival major leagues, together with the Northwestern, a minor league, entered into an alliance under the National Agreement, a document which provided for mutual respect of territories and player contracts. This agreement marked the birth of what has become known as "organized baseball."

When the Union Association challenged this structure in 1884, it was destroyed by the major league combination, which then enjoyed a rising prosperity throughout the remainder of the decade. However, the increasing strictness of the major leagues' labor policy and certain tactics regarded as abuses by the players resulted in the formation of a union, the Brotherhood of Professional Base Ball Players. Finally, in 1890, the players joined forces with outside capitalists to form the Players League, a cooperative enterprise in which players and owners were to divide the profits. All parties concerned suffered severe financial loss in the trade war which followed, and the disastrous year ended in the defeat of the Players League, whose clubs were either bought out or consolidated with League and Association clubs.

By 1890 it was estimated that approximately eight million people were paying admission to ball games throughout the country. Not only did various other businesses such as sporting goods, breweries, newspapers, streetcar lines, railroads, hotels, and the telegraph have a natural affinity for the game; but business at large found it advantageous to foster professional

baseball and to identify with it through advertising. Names of baseball stars like "Cap" Anson and "King" Kelly became household words; women increasingly attended games; and interest in baseball was reflected in songs, in literature, on the stage, and in the language itself. "The National Game" had become a permanent part of the American scene and was associated with it in much the same way as the Olympic Games are associated with Greece and cricket with England.

659 pages. \$8.35. Mic 56-3407

**AN UNSUCCESSFUL EXPERIMENT  
IN INDUSTRIAL DEMOCRACY:  
THE COLUMBIA CONSERVE COMPANY**  
(Publication No. 17,984)

Russell E. Vance, Jr., Ph.D.  
Indiana University, 1956

From the time of its incorporation in May, 1910, until February, 1917, the Columbia Conserve Company, packers of quality tomato products and soups, operated as any other industry. Beginning in February, 1917, William P. Hapgood led the company in establishing what he called an experiment in industrial democracy to determine what the average worker could accomplish when given the responsibility of managing an industrial plant.

The workers controlled this canning company from 1917 to 1926, through an elected council and the Board of Directors whose membership was made up of salaried employees. In 1926, a contract was signed between the original owners and the salaried employees, giving the latter the future profits of the company with which they were to purchase the common stock of the company. In July, 1930, the workers collectively owned 51 per cent of the stock and thus controlled the company. Trustees, elected by and responsible to the workers, controlled and voted this collectively-owned stock when necessary, as directed by a majority vote of the salaried employees.

From 1918 to 1942, the management of the company was directed by the workers' council which came to include all salaried employees. This body elected additional workers to salary and thus to co-ownership, elected the plant manager and all other officials, set the salaries of each individual, directed the production, and had complete control over company affairs.

During these years, the majority of the workers received an annual salary and guaranteed annual employment. They were paid for an unlimited amount of sick leave, given three weeks paid vacation, complete health protection and care for themselves and their dependents, pensions, and special assistance for financial needs. After 1928, the salaries were paid on the basis of need rather than on efficiency.

The company experienced two major periods of trouble. In 1933, a factional dispute developed over the control of the company management. In 1942, after organizing a union affiliated with the American Federation of Labor, the salaried employees led a strike which later resulted in a suit for a receivership. During the court action which followed, the trust which had been established by the employees to direct the collectively-owned

stock, was dissolved and the shares were divided among them on a pro rata basis. After this distribution, the company once again returned to a traditional industrial management.

As a business the Columbia Conserve Company was not a shining example of success, but the employees received salaries above the national average in cannery plants and enjoyed employment during the depression although their salaries were considerably reduced.

Throughout the history of the company, experiments were carried on, most facets of labor-management problems were experienced, and additional innovations were made.

In 1953, after fifty years in business, twenty-six of which involved worker-control and worker-ownership, William P. Hapgood sold the company and deposited the papers of the company in the Indiana University Library. This dissertation relating the history of the company is mainly written from research in these papers.

400 pages. \$5.10. Mic 56-3408

**URBAN PROTESTANT REACTIONS  
TO THE CHICAGO HAYMARKET AFFAIR, 1886-1893**

(Publication No. 18,564)  
Lewis Frederick Wheelock, Ph.D.  
State University of Iowa, 1956

Chairman: Professor Stow Persons

The Haymarket Affair in Chicago illuminated the development of American urban Protestantism during the last two decades of the nineteenth century. The Haymarket affair included the riot and bomb throwing in Chicago on May 4, 1886; the trial, the appeals, the unjust execution of four convicted anarchists in 1887 and the imprisonment of three; and the final pardon of the imprisoned men by Governor John Peter Altgeld of Illinois in 1893. This interrelated series of events from 1886 to 1893 occurred during the period of accelerated transition in America from rural agricultural society to an urban industrial society.

It has been assumed that the urban Protestant churches in America following the Civil War displayed hostility toward and ignorance of working people and their problems. It is implied that this was due to an alliance between the urban churches and the industrial upper classes whose money supported these churches. This interpretation also claims that only the increasing labor upheavals and the doctrines of the emerging social gospel turned the churches back to a forgotten social responsibility. An analysis of the reaction to the Haymarket affair by Protestant clergymen, laymen and the protestant religious press would indicate the necessity of modifying that interpretation.

The churches of the Chicago area were not growing disproportionately wealthy during this period. Furthermore, in national conferences and in local sermons most denominations displayed a remarkably liberal and responsible attitude toward urban social problems before and during the Haymarket Affair. This was even more remarkable in Chicago where institutional instability,

largely caused by the rapid growth of population, intensified social unrest and added to the confusion of those who sought to understand the new problems. Also at a time when churchmen were attempting to understand the new urban industrial problems, labor was itself changing. The fraternalistic utopianism and emphasis on non-violence of the waning Knights of Labor was more compatible with traditional Protestantism than was the emerging new "businessman" unionism of the American Federation of Labor.

The churches in Chicago shared with other institutions in the city the instability attendant upon a recent emergence from a village status. At the same time they were faced with metropolitan social and economic tensions. Churchly denominationalism was being reasserted at the very time the Haymarket Riot heralded America's first "Red Scare."

At a time when various usually outspoken liberals were quelled by the local and national hysteria produced by the Haymarket riot, Chicago clergymen were not slow to face the situation or to blame themselves for not having done more for the working people. Ironically, such exaggerated self-criticism by local clergymen and by regional and national conferences helped form later the basis for an exaggerated view of urban Protestant hostility to working people during this period.

Crises such as the Haymarket riot and the doctrines of the emerging social gospel have been over-emphasized as agents active in turning urban Protestantism back to a supposedly forgotten responsibility to dispossessed elements of American society. In Chicago before and during the Haymarket affair the churches remained remarkably faithful to and aware of their responsibilities to all elements of society. 375 pages. \$4.80. Mic 56-3409

## LANGUAGE AND LITERATURE

### LANGUAGE AND LITERATURE, GENERAL

#### THE ROLE OF SIR DAVID LYNDSDAY IN THE SCOTTISH REFORMATION

(Publication No. 17,293)

William Robison Barclay, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor Robert Presson

There is remarkable agreement among historians that the Roman Catholic Church in Scotland during the first half of the Sixteenth century was in particular need of reformation. But Reformation in the sense of separation from Rome came late in Scotland. More than forty years elapsed between the time that Luther nailed his theses at Wittenberg and the time that the Scottish Estates officially established the Protestant national Church; nearly thirty years had gone by since the English Convocations had declared Henry VIII to be the supreme head of their Church "as far as the law of Christ allow."

It was during the difficult years between Luther's open break with Rome and the creation of the independent Scottish church that all the known works of Sir David Lyndsay were written. One of his major accomplishments was a thorough-going attack on abuses of the Church and especially of churchmen, and it is as a satirist of the "auld kirk" that he is best known today. But this was only one of his poetic themes. Injustice, lack of domestic order, the function and powers of monarchy, ethical behavior in commerce and the trades, the inhumanity and the waste of war--these and many other topics that today seem social rather than religious receive treatment equal in intensity and bite to his better known religious satire. It is significant that when Lyndsay describes the damned at the time of the last judgment it is cruel shedders of innocent blood--not popes and bishops or even scheming

friars and lecherous priests--who lead the baleful band. The welfare of the Scottish commonalty, physical as well as spiritual, was his chief concern; a critical view which presents Lyndsay as solely or even chiefly concerned with religious reformation, whether in the general sense of improvement of clerical standards or in the more limited sense of establishment of Protestant doctrine and polity, overlooks a great part of his most skillful and most impassioned poetry.

Where Lyndsay did concern himself with primarily religious matters, his aim was still centered around the welfare of the individual. To aid the individual in securing salvation was to him the first purpose of the Church, and in aiding men in this attempt, the Church would also lead men to good works. Those churchmen and also those institutions of the Church which stood in the way of this goal Lyndsay condemned. He did not, however, condemn completely the Church in which he had grown up, nor did he automatically accept all doctrines and practices of the reformers.

While it cannot be maintained that Lyndsay remained a loyal Roman Catholic, it cannot be said either that he became a doctrinaire Protestant. Lyndsay went further than Luther in denouncing auricular confession, but he is as conservative as Aquinas regarding the importance of caritas. He approaches Calvin in his views about predestination, but his attitude toward the Virgin Mary is basically that of medieval Catholicism. Such independency was no more a virtue to Geneva-inspired Scottish Protestantism than to Roman Catholicism. Lyndsay's writings do show clearly that malpractices in the Church were important to him; they do not show that the overthrow of the Church was important. The issue of which church was never central with Lyndsay. The issue of vigorous and moral leadership from the spiritual estate was.

369 pages. \$4.75. Mic 56-3410

## THE IRONY OF JOSEPH CONRAD

(Publication No. 18,491)

Dorothy Snodgrass Brown, Ph.D.  
University of Washington, 1956

The purpose of this thesis is to contribute to the understanding of Joseph Conrad as artist and as man by examining in detail the irony in his fiction. An intensive study has been made of seven novels and three tales containing his most representative irony.

Conrad's dramatic irony, his comic treatment of minor characters, his frequently critical portrayal of protagonists, and the tragic patterns of the lives of many of the people in his books enhance his art. His irony is the result of his sardonic sense of humor and his pessimism, but his pessimism never reaches the point of despair.

Irony in Conrad is directed against economic progress, political revolution, and Providence. The irony of economic progress is present in Conrad's first novel, Almayer's Folly, and in many of his other novels and stories. The most outstanding example of this type of irony is in Nostromo, in which the symbol silver plays a more important role than any character. Gold, ivory, and coal are used as ironic symbols of greed in other works, notably Almayer's Folly, "Heart of Darkness," and Victory.

The irony of political revolution is most thoroughly treated in The Secret Agent and Under Western Eyes. Conrad was especially impatient with the insincerity of revolutionary leaders. Their activities and affiliations seemed to him to be the result of an unwillingness to put forth the effort necessary to prosper in the existing state of society.

The irony of Providence, like the irony of economic progress, is pervasive throughout Conrad's work. It is especially noticeable in Lord Jim and in Victory. It is not completely pessimistic, however, for in Conrad's ironic vision the indifference or malevolence of Providence is defeated by the steadfastness of man.

183 pages. \$2.40. Mic 56-3411

LES VOEUX DU PAON BY JACQUES DE LONGUYON:  
AN EDITION OF THE MANUSCRIPTS  
OF THE P REDACTION

(Publication No. 17,046)

Brother Camillus Casey, O.S.F., Ph.D.  
Columbia University, 1956

Les Voeux du paon by Jacques de Longuyon was written in the early fourteenth century before the year 1313. Of the author nothing is known except that he was from Longuyon in Lorraine and that he wrote his poem for Thiebaut de Bar, bishop of Liège, who died in 1312. The popularity of the poem is attested to by the fact that it gave new vigor to the type of literature which has as its theme the taking of vows to perform some noble deed, as well as by the great interest it aroused in the Nine Worthies. Translations into other languages testify to its popularity outside of France. The text exists in thirty-four manuscripts and five fragments. No published edition

of this French poem of approximately 8500 lines has been made except that of R. L. Graeme-Ritchie to accompany the Scotch translation entitled The Buik of Alexander. A new edition of the poem written from the point of view of French medieval romance is necessary because Ritchie's edition is intended only as an accompaniment to the Scotch translation. He used as the basic text Manuscript W (BNF 12565), which represents the latest version of the poem. His edition contains no critical notes or vocabulary for the French text. The variants he gives are for those manuscripts only which are located in England, and these variants contain numerous errors. The present study, intended as a preparation for a critical edition based on all the manuscripts, deals only with the eight manuscripts of the P redaction which, together with the Q manuscripts, represent the earliest version of the poem. Manuscript P (Bodley 264) has been chosen as the basic text not only because of its great beauty, but also because it frequently reads with P1 and P8 as opposed to the other P manuscripts which represent a later reading. P is written in the standard Franco-Picard literary language, but it alone contains a few phenomena of the Lorraine dialect of the Meurthe-et-Moselle section of Northern France from which the author came. This edition contains in the Introduction, a study of the manuscripts, their relations, a study of the language of the author and of the scribe of P, the position of the poem in the Roman d'Alexandre, and a brief study of the versification. Complete variants, except those of an orthographical or dialectal character, accompany the text for all the P manuscripts. Critical notes, a glossary, and an index of proper names follow the text.

The romance, though it was written as an independent poem, may be intercalated in the Roman d'Alexandre since its starting point is a continuation of the Prise de Defur and the Fuerre de Gadres. On his way to Babylon Alexander comes to the assistance of Cassamus and his nephews and niece, whose city of Epheson is being besieged by Clarus. Porrus, one of Clarus' sons who has been taken prisoner, shoots down a peacock. The peacock is roasted and served at a banquet at which all the guests vow to perform some noble deed. In the ensuing battle all the vows are fulfilled except that of Edea to restore the peacock in gold. Woven throughout the background of the story are the love affairs of Porrus and Fezonie, and others. The story ends with the burial of Cassamus, Clarus, and the other knights who have been killed in the battle. Of especial note are the sections which give a description of a chess game, the fullest one to be found in Medieval French literature, and an Excursus on the Nine Worthies.

553 pages. \$7.05. Mic 56-3412

## THE NOVELS OF EDWARD BULWER-LYTTON

(Publication No. 19,238)

Joseph Irwin Fradin, Ph.D.  
Columbia University, 1956

Between 1827 and 1873, Edward Bulwer-Lytton wrote some two dozen novels, frequently provocative, of widely varying subject-matters. Nearly all of the novels were very popular; they were influential in establishing tastes

in fiction; they stimulated other writers, notably Charles Dickens.

Most modern commentators on Bulwer have thought of him as a popularizer, a mere caterer to public demands. This essay demonstrates first, that despite their variety of form and content, Bulwer's novels have a common concern with social and intellectual issues as Bulwer saw them; and second, that Bulwer wrote his books because they supplied him with a needed release from the tensions under which life held him.

I have divided the novels into seven groups: apprenticeship novels; criminal, sensational, occult, and historical novels; the Caxton or "family" novels; and a final trilogy.

The apprenticeship novels early establish Bulwer's seriousness of purpose and the conflict in him between politics and literature. They begin Bulwer's attack on materialism. The dandyism evident in them is essentially a rejection of the soiling world of competition and commerce and an expression of Bulwer's dramatic sense of his own uniqueness. The same idea of personal separateness is clear in the criminal novels, for Bulwer identifies himself with the scholar-outcast in Eugene Aram and sympathizes with the man-in-revolt in Paul Clifford. Both these novels examine the paradox that minor crime is severely punished by society while major vice is condoned. Paul Clifford, in addition, makes a specific attack upon the penal code.

The sensational novels Night and Morning and Lucretia illustrate Bulwer's growing social awareness. Night and Morning cries out against the cash nexus and false respectability, much as Dickens later does in Martin Chuzzlewit. Lucretia recognizes that money is a great social fact which should be dealt with in novels; it traces the evil effects of money at several levels of society.

Bulwer's occult novels, Zanoni and A Strange Story, continue his assault on materialism and give evidence of his search for faith and stability. They attempt to understand developments in science and pseudo-science and the adjustments to such developments the Victorians had to make in their thinking. In A Strange Story Bulwer also tries to define the role of the unconscious mind in the experience of reality and the way in which the unconscious may help the artist to discover new symbols to express "the poetry of modern civilization."

Laurence Sterne has significance in the Caxton novels. Sterne's technique is connected in Bulwer's mind with the idea of a world broken up by man's different discoveries about himself, his society, and his universe. But paradoxically, Tristram Shandy provides Bulwer with the sense of family as an antidote to insecurity. In the Caxton novels the basic unit of security is the Caxton family, and the model of behavior is the gentleman, defined in terms of family virtues and affections.

In Bulwer's historical novels, his uneasiness is expressed by his reiterated fear of the mob in Rienzi and The Last Days of Pompeii and by his numerous images of catastrophe. In The Last of the Barons he inveighs against the spirit of commercialism and its destroying effect on British values.

Of his last three novels, Bulwer deals with the breakdown of the family and the continuing possibility of revolution in The Parisians; attempts unsuccessfully in Kenelm Chillingly to re-establish the sense of family so successful in The Caxtons, and, in The Coming Race,

warns against the dangers to art and individuality of a "perfected" society. 344 pages. \$4.40. Mic 56-3413

#### CONVENTIONS AND CHARACTERISTICS IN THE ENGLISH FUNERAL ELEGY OF THE EARLIER SEVENTEENTH CENTURY

(Publication No. 18,578)

Hilda Hanson Hale, Ph.D.  
University of Missouri, 1956

Supervisor: Donald B. Clark

The English funeral elegy written between 1600 and 1640 possessed certain conventions and characteristics which made it a distinct genre. This study examines these conventions and characteristics in the elegies of nineteen poets of the period, poets who represent several generations and a number of poetic schools.

The study first considers problems which arose during the investigation: the confusion created by the seventeenth-century poets' habit of using the term "elegy" for any poem with which they associated the use of the elegiac distich and by the lack of discrimination on the part of the poets of the period in the use of the terms "elegy" and "epitaph"; the relationship of the consolatory poem of the period to the elegy; the reasons for the great increase in the number of funeral elegies written during this period, and the relationship of the desire for patronage and ferment to the writing of elegies.

For the purpose of examining elegiac conventions and characteristics, the elegies are considered in this study as falling into three groups: those which were chiefly concerned with an expression of grief; those which were chiefly concerned with reflections on the meaning of death and immortality; and those which were chiefly concerned with praising the virtues of the deceased.

The major convention through which poets expressed grief appears to have been the use of the tear conceit. Tear conceits have a long and complex history, and while the elegy made the greatest use of them, the tear conceits of the elegy were related to, and influenced by, those in the lyrical and devotional poetry of the period. A variant form of the tear conceit, a blood conceit, appeared in the indignant elegies on the death of Charles I.

Reflective elegies employed traditional images to express attitudes toward death and immortality. Some of these images, particularly those which dealt with the sickness preceding the death, are startling to the modern reader, but were conventional in the seventeenth-century elegy. Traditional images which were concerned with death and immortality dealt not only with the sickness preceding the death, but also with the actual dying, the body in the grave, the resurrection of the body, and the happiness of the soul in heaven.

Eulogistic elegies did not commonly contain the traditional conceits and images of the other two types, but did contain two elements deserving of mention in a study of the elegy of the period. The intent of the poets to praise the dead led to satire when the poets emphasized the virtues of the deceased by contrasting them with the lack of virtue of the living. A large number of elegies in

this period were written on the death of poets, and, in these, the elegists praised the dead poets' works rather than their personal virtues, so that these elegies contained a good deal of literary criticism.

The versification of all three types of elegies written in this period was largely standardized. The majority of elegies were written in pentameter or tetrameter couplets, the greater number being in pentameter couplets. The pentameter couplet written by these elegists did not prove upon examination to have contributed greatly to the development of the heroic couplet which took place in the first half of the seventeenth century, although a few elegists in the late 1630's did employ couplets which had most of the characteristics of the heroic couplet.

326 pages. \$4.20. Mic 56-3415

**ELLEN GLASGOW'S IDEAL OF THE LADY  
WITH SOME CONTRASTS IN SIDNEY LANIER,  
GEORGE W. CABLE, AND MARK TWAIN**

(Publication No. 19,095)

Harrison Ewing Hierth, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harry H. Clark

Since, broadly contrasted to the North, the South is supposed to have been more belatedly hospitable toward the concept of the lady inspired by such influences as Walter Scott's chivalry, mediaeval Christianity, and sentimentalism, it is interesting to examine in detail the manner in which Ellen Glasgow's work, begun in 1897, mirrors the complex changes of attitude toward what the lady ought to be, with some contrasts in the work of Sidney Lanier, George W. Cable, and Mark Twain.

Miss Glasgow is most markedly the feminist; but examination of her nineteen novels and analysis of some eighty-five female characters reveals that her view of women is, nevertheless, incomplete. Women's political rights and higher education for women do not concern her. She slights the relation of women to their children. She portrays marriage as an unsatisfactory relationship, notably in The Romantic Comedians, They Stooed to Folly, and Life and Gabriella. She does, however, believe that woman's capabilities ought to be developed, that she should be useful, and that, above all, she must develop a life outside the bonds of a romantic, man-made code of behavior. Repeatedly Miss Glasgow declares, "There must be something besides love to live for." The chief quality of her ideal woman, seen in such heroines as Dorinda Oakley, Gabriella Carr, and Caroline Meade, is realistic, free-willed fortitude, the "vein of iron," which produces a useful, satisfying life not dependent upon subservience to the male notion of what constitutes the "womanly woman."

Contrasting sharply with Miss Glasgow is the chivalric Sidney Lanier, who in his anti-feminist "Furlow College Address," 1869, finds his ideal in the Southern lady on her pedestal--the angel who inspired the Confederate soldier, and whose proper place Lanier believes to be in the home. To Lanier, "wife-love and Christ-love are one." He believes Christian and chivalric love, practiced as an active

philosophy, to be the surest way of improving society. Love is, therefore, all in all to Lanier's ideal lady, as one sees in Tiger Lilies. Lanier is on the side of heart, although not a sentimentalist of the Richardson-Sterne variety. Especially in "The Symphony" he claims that industrialism ("trade") is an enemy of chivalric love and forces into mercenary marriage the woman whose suitor now says, "Here, you Lady, if you'll sell, I'll buy."

George W. Cable and Mark Twain fall between these extremes. Cable, relatively matter-of-fact in his treatment of women, sees in them abilities which have nothing to do with sex. He is compassionate toward Creole women and women of mixed blood. The plight of the latter he believes to be attributable to a defective society, and he is a believer in making practical reforms in institutions.

Mark Twain, as does Miss Glasgow, deplores "girly-girly" romance. As creator of Roxy and satirist of Sandy, he deplores Southern "chivalry-silliness," for which he blames Walter Scott. But he cannot get permanently away from the romantic himself. He can see women as a moral force, look forward to her becoming a voter, and recognize her fitness for a career. But he can also out-do Scott in the chivalry of Joan of Arc, remain strait-laced in his views of sex (despite an occasional lapse as in "1601"), and actually prefer the "womanly" woman.

All, even Lanier in his dialect pieces, advanced the cause of realism in American literature; and each recognized the fact that a truly vital literature must not be narrowly sectional. Together they record some of the growing pains of the Nineteenth Century South.

326 pages. \$4.20. Mic 56-3416

**THE MORAL VISION OF SHAKESPEARE'S  
TROILUS AND CRESSIDA**

(Publication No. 17,963)

David Charles Kaula, Ph.D.  
Indiana University, 1956

Troilus and Cressida has often been called one of the least Shakespearean of Shakespeare's plays. Critics of the nineteenth century believed that it must have been written by a man who had suffered some soul-shaking experience--an unhappy love affair or an abrupt change in Weltanschauung. More recently scholars have tried to show that Shakespeare dealt so harshly with the Homeric and Chaucerian characters not primarily because he wanted to, but because he was forced to by literary precedent and the expectations of his audience.

The purpose of this study is to show that Troilus is not an un-Shakespearean play. The underlying moral perspective of the play is, like that of Shakespearean drama in general, essentially an orthodox Christian one. In the combined communities of his Greeks and Trojans Shakespeare presents what may be described as a post-medieval vision of the Augustinian earthly city. The characters are unable to resolve their personal and social dilemmas, not merely because they are ruled by "passion" rather than "reason," but because their wills are directed toward no other good than the good of the self. In letting themselves be governed by self-love rather than charity they commit the error (as Hector says) of making "the service greater than the god."

Shakespeare reveals this moral failure among his characters in several analogous ways. Through the love plot and its key figure, Troilus, he implicitly evaluates certain attitudes associated with Renaissance idealism and courtly love. Through the war plot and its key figure, Ulysses, he analyses the values supported by Renaissance rationalism, neoclassicism, and Realpolitik. He thus provides an elaborate critique of both some of the conservative and some of the progressive aspects of Elizabethan culture.

To Troilus Shakespeare assigns a form of love which is more egotistical than neighborly. Troilus is not interested in Cressida as a person to be cherished for her own sake so much as he is using her as a means of transcending the limitations of ordinary life and uniting himself with the Absolute. When he fails to achieve this apotheosis he falls prey to fatalistic despair, finding death more attractive than existence in a world which he believes has shamefully betrayed him. Troilus' love thus exhibits the same dualistic emphasis which may be observed in Renaissance Neoplatonism, medieval courtly love, and, behind these, the ancient heretical tradition of supernaturalism in which these movements partially originated.

Although Shakespeare emphasizes Cressida's weaknesses more than Chaucer, he does not treat her as scornfully as other post-Henrysonian retellers of the story. He portrays her not simply as a wanton deceiver, but as the naive and helpless victim of a community which provides its members with no certain discriminations between right and wrong--a community which holds up Helen as the paradigm of feminine excellence. Shakespeare deviates most radically from Chaucer in placing the love story within such a milieu, and in subjecting the characters to the very tangible pressures of time, place, and historical circumstance. Chaucer explicitly related the lovers' experiences to a timeless and universal order of value. He shows the tragedy of man's earthly existence eventually superseded by the "comedy" of his ultimate redemption. Shakespeare shows the tragedy but not, within the limits of the play, the redemption.

To the romantic and idealistic tendencies of the Trojans Shakespeare opposes the more up-to-date attitudes of the Greeks: Stoicism (in Agamemnon and Nestor), cynicism (in Thersites), and political realism (in Ulysses). The Greeks on the whole regard the war, as they do all human existence, as largely purposeless and irrational. They are not concerned with collective endeavor so much as they are in with the exhibition of personal prowess. Even the most clear-sighted individual among them, Ulysses, makes no attempt to exert a moral influence in his efforts to "physic" the intransigent Achilles. Whatever his eloquent pronouncements on the subjects of "time" and "degree," his underlying purpose is strictly utilitarian.

The extent to which Shakespeare departs from one of his major sources, Chapman's *Iliades*, is clearly indicated by the fact that he portrays Achilles not as an exemplum of Stoic virtue but as a sadistic boor. Chapman utilizes Achilles as a pretext for exalting the aloof and self-sufficient ego and the classico-humanistic virtues of reason, fortitude, and self-control. These, however, are the very qualities which Shakespeare, chiefly in the interplay between Ulysses and Achilles, shows as eventuating in utter moral and spiritual futility.

262 pages. \$3.40. Mic 56-3417

#### THE IMAGE OF PARADISE IN OREGON

(Publication No. 19,248)

Ray C. Longtin, Ph.D.  
Columbia University, 1956

When the proponents of "manifest destiny" in Congress (though the phrase was as yet uncoined) first began to look to the Pacific Coast in the 1820's, they found they had three popular concepts to combat: the myth of the Great American Desert, the myth of the insurmountable mountain barrier, and the myth of the Oregon wilderness. The first two images of continental barriers had been fostered by the explorations of Pike, Long, and Lewis and Clark, but even before these conceptions had become firmly imbedded in the American consciousness, the image of the Northwest Coast as a barren wilderness had been created by a series of eighteenth-century maritime tales of exploration and trade along the shoreline of that coast. It is clear, at least in retrospect, that if successful expansion to the West Coast were ever to be achieved, both the myths of desert and mountain, and the image of the Oregon wilderness had to be dispelled. This work is a study of how one of these mental barriers, the vision of the wilderness in Oregon, was finally altered into a new version of the age-old image of Paradise. The material which is analyzed is the literature of travel and description on the Oregon country from its discovery to the settlement of the boundary dispute with England in 1846.

In an analysis of the development of the Paradise image for Oregon four distinct steps are evident. First, the image of the wilderness was the prevailing view presented by the early maritime and transcontinental explorers and fur traders. From Captain Cook (1778) to the overland Astorians (1811) the general picture offered was one of danger, desolation, and gloom, of rocky and inaccessible coasts, of precipitous mountains and treacherous river rapids, and of hostile and capricious Indians. However, in the works of some of these early writers there was an occasional portrayal of a landscape scene in the traditional terms of the eighteenth-century "picturesque" or "beautiful." When this occurred there was material for the later creators of the image of Paradise in Oregon.

The second step was the creation of that very vision of a new Oregon Eden by eastern advocates for settlement--by men who had never seen the land they were describing. Unlike the classic image of a workless Paradise, this was a Paradise of Work, or an agrarian dream of the future. It was presented for the first time publicly during the Congressional debates of the 1820's. The supporters of the new Paradise theme utilized the descriptions of the early travellers, but carefully culled the material, ignoring all that was derogatory and elaborating on those pleasing descriptions of picturesque landscapes noted above. Outside of Congress the vision was presented in exuberant terms by an early Oregon propagandist, Hall Jackson Kelley, in the New England press and on local lecture platforms. During all of this time, however, there were vehement opponents to Oregon settlement who retained and publicized the traditional wilderness image.

The third step was the presentation of the Paradise image by contemporary travellers into Oregon -- by men who had actually seen the region they were describing. Of the different groups in the 1830's who were able to describe the Pacific Northwest from actual experience, by far the

most important were the missionaries. These men and women went into the area especially prepared to note agricultural potentialities, and their enthusiastic reports to the missionary journals had a wide and responsive audience.

The final step in the development of the Paradise image for Oregon was the rapid and sensational triumph of that vision as it was evidenced in the Oregon fever of the 1840's. The settlers' response to Oregon was ambivalent, some retaining and continuing the dream in reports to their stay-at-home friends, others showing great disappointment at the bursting of their dream by reality. However, by 1846 the vision of Paradise had done its work, and the settlement of the boundary dispute with England was but one practical result of the alteration of a mental barrier -- from the old wilderness image to the image of Paradise in Oregon -- which had been achieved in two short decades.

233 pages. \$3.05. Mic 56-3418

#### FAUST IN ENGLAND: 1800-1850

(Publication No. 19,251)

Lore Metzger, Ph.D.  
Columbia University, 1956

Through a detailed analysis of carefully selected texts, this study reveals the quality and extent of the influence of Goethe's Faust on English literature of the first half of the nineteenth century. In order to explore such influence, it was necessary to consider the availability of English translations of Faust and to examine its reception and interpretation by contemporary critics.

Byron's Manfred, Cain, and The Deformed Transformed were the first important English poems for which Faust furnished the germ. Whereas Byron adapted passages that demonstrate Faust's divided soul, his indomitable will, and his titanic aspirations, Carlyle, in Sartor Resartus, retailed Faust in prophetic dress: Goethe's protagonist became the conqueror of despair, the exemplar of the conversion from despondency to social activity.

Faustian activism pervaded much early and mid-Victorian poetry and prose. Kingsley's writings are typical: his sermons, lectures, essays, and novels stress the necessity of discontentment with human nature and with social conditions, as well as the importance of restless striving. Man's aspiration could be fruitful, according to Kingsley, Carlyle, G. H. Lewes, and many other Victorian writers, only through the renunciation of the unattainable and the concentration on what lies within man's reach. Goethe's statement of the doctrine in the second part of Faust lent authority to the Victorian apostles of action.

The Faustian hero, whose divided soul and insatiable thirst for experience had fascinated Byron, persisted in many "Spasmodic" poems--in such extravagant form that he was parodied by W. E. Aytoun and Arthur Hugh Clough. The earliest Victorian Faust, Browning's Paracelsus, does not represent an ideal but a warning: the arrogant impulse to strive with gods, to transcend human limitations, constitutes a tragic flaw. Bailey's Festus, however, attempts a compromise: he seeks to reconcile bold aspirations with Christian meekness and to combine

egocentric search for experience with social responsibility. Much admired and widely imitated, Festus began a vogue of stereotyped Faustian heroes, which did not survive, however, Aytoun's satirical attack. His Firmilian and Clough's Dipsychus effectively discredited the Faustian necessity for leading an active life at all cost.

In a more serious vein than that of Aytoun and Clough, Matthew Arnold's Empedocles demonstrated the impossibility of the Faustian ambition to encompass all existence and the necessity for moderation. Although Empedocles voices this moral lesson, his own life lacks a firm basis and only death can bring him equilibrium. His death introduces another Faustian theme: faith in the process of life, a process which links the end of the individual life to a new beginning.

Tennyson connects this theme with Goethe's name in In Memoriam. In his "Ulysses," the hero voices man's yearning to realize his supreme flights of hope, which, in "The Two Voices," the Mephistophelian spirit exposes as mere illusion. Out of the struggle between idealism and nihilism emerges Tennyson's faith in the divine purpose of the universe. And Goethe, especially in the second part of Faust, confirmed that the alarming facts of nineteenth-century science could be reconciled with faith in the all-pervasive divine spirit, and that, moreover, phylogenetic evolution corroborated spiritual development beyond a single lifespan.

210 pages. \$2.75. Mic 56-3419

#### THE KARUNĀPUNDARĪKA: CHAPTERS I AND II

(Publication No. 17,286)

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The Karunāpundarīka, the "Lotus of Compassion," is a fourth century Mahāyāna Buddhist text, composed in six chapters, of which the first two, entitled "Turning the Wheel of the Doctrine" (dharmaçakrapravartana) and "Introduction to Magic Formulae" (dhāraṇīmukha), are edited and translated in this dissertation.

The text exists in four versions or translations: Buddhist Hybrid Sanskrit, Tibetan, Chinese, and some Middle Iranian (Tokharian) fragments. Only the Buddhist Hybrid Sanskrit version is considered here, although the other versions are briefly indicated in the Introduction.

This edition of the Karunāpundarīka was prepared from microfilm facsimiles of six Buddhist Hybrid Sanskrit manuscripts. Its critical apparatus also includes material from the published text of the Karunāpundarīka (Rai Śarat Chandra Dās and Pandit Sarat Chandra Sāstri, Calcutta: Baptist Mission Press, 1898), as well as parallelisms from other Mahāyāna Buddhist texts, particularly Sad-dharmapundarīka, Daśabhūmikasūtra, and Bodhisattvabhūmi.

The dissertation is divided into the following major sections: Preface, Introduction, Index, Bibliography, Abbreviations, Text, Variant Readings, Translation, and Concordance. The Preface (pp. ii-vii) presents a brief historical background of this project and the reasons for its undertaking. The Introduction (pp. viii-xlii) describes

the work in general, with particular regard to its position in the history of Mahayana Buddhist sacred writings. Also included in the Introduction is a description of the materials used in the preparation of this edition, and various linguistic features of the manuscripts, orthographical, phonological, morphological and syntactical. An English Index (pp. 1-lxxiii) to the Translation, with corresponding Buddhist Hybrid Sanskrit equivalents, is also provided. The Concordance (pp. 187-356) includes the principal Sanskrit words, given in their contexts, and additional notes. Throughout this dissertation there are copious cross references to Prof. Franklin Edgerton's Buddhist Hybrid Sanskrit Grammar and Dictionary (New Haven: Yale University Press, 1953).

The critically edited text (pp. 1-48) was prepared from a collation of the six manuscripts. Variant readings (pp. 49-116) of the manuscripts are fully indicated. The translation (pp. 117-186), though literal, attempts to preserve the stylistic features of Buddhist writings without encumbering the English reader with untranslatable nomenclature.

After an introductory verse, the first chapter opens with a lengthy list of Bodhisattvas, disciples (śrāvakas), etc., which is similar to the listings of the Saddharma-puṇḍarīka and Lalitavistara. Following the usual display of magic power by the Lord (bhagavant), a Bodhisattva named Ratnavairocana inquires about the source and nature of these miracles. The Lord then describes a Buddhist heaven (lokadhātu), called Padmā, and its Tathāgata named Padmottara. This description of the Padma-world resembles material found in the Sukhāvativyuha.

The second chapter continues the dialogue between Ratnavairocana and the Lord about the Padma-world. This chapter delves deeper into the history of the Padma-world and its Tathāgata, Padmottara, who was formerly a Bodhisattva named Gaganamudra. Padmā was previously called Candanā and its Tathāgata was named Candrottama. The principal doctrine taught by Candrottama was the method of introduction to magic formulae, which are the modes of all knowledge (sarvajñatākāradharāṇimukha). This teaching, which is illustrated by two listings of magic formulae (dharani), is the principal feature of the second chapter. After the efficacy of this doctrine is indicated, the various religious qualifications (dharma), which a Bodhisattva must have in order to appropriate this teaching, are described. The section describing these qualifications is based on material found in the Dīgha Nikāya. In the later part of the second chapter, the Bodhisattva Maitreya is introduced, and his vow (prañidhāna) is discussed. The religious progress of Bodhisattvas is measured in terms of particular stages (bhūmi) of enlightenment. After another magical display of light by the Lord, the chapter concludes with a description of the efficacious effect which this sublime light has on creatures doomed to dwell in the nether worlds.

The particular value of these two chapters of the Karunāpuṇḍarīka to Mahāyāna Buddhist studies derives from its historicity, which predates Tibetan and Chinese translations, and the wealth of the material concerning magical formulae which it provides. Because of its extensive vocabulary of technical Buddhist Hybrid Sanskrit terminology, this portion of the Karunāpuṇḍarīka constitutes a succinct and valuable handbook of Mahayana Buddhism.

446 pages. \$5.70. Mic 56-3420

#### FIGURATIVE IMAGERY IN THE RING AND THE BOOK: A STUDY IN BROWNING'S POETIC TECHNIQUE

(Publication No. 17,989)

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Indiana University, 1956

This dissertation is an effort to discover how figurative imagery functions in the artistic design of The Ring and the Book and, at the same time, an attempt to discover, through a detailed examination of the figurative imagery of Browning's longest and most representative poem, what are the distinctive characteristics of Browning's imagistic technique.

Browning employs a great variety of recurrent images in The Ring and the Book, the majority falling into two general groups: images drawn from nature--plants, animals, birds, and insects--and from light, fire, and colors. Recurrent images are employed, first, as a means of characterization. Several different but related images are consistently used to represent and hence characterize Pompilia, Guido, and Caponsacchi. Images employed throughout to represent Guido are the wolf, the hawk, Satan, fire, and redness. For Pompilia, the chief recurrent images are flowers of various kinds, usually white; the lamb; the dove and other birds; whiteness; and the Virgin Mary. The star is the dominant image for Caponsacchi, though other forms of white light are frequent variants.

The recurrent images, cutting across formal divisions of the work, also help to bind the separate monologues together, providing an organic unity and lending a unified tone to the whole, a primitive, earthy tone appropriate to the poetic statement. The recurrent nature images, in addition, provide a means for the poet to enunciate his philosophy of "natural" goodness.

The image content employed in each monologue does not forcibly point up the individual qualities of the speaker. The similarity from Book to Book, rather than the differences, emerges as the outstanding fact concerning the image content of the poem. Moreover, there does not appear to be a true "dominant" image in any one of the monologues.

However, each speaker does employ a characteristic image type, in terms of image structure and function. Pompilia, for example, frequently represents her own states of mind and feeling in images of homely, everyday incidents and objects drawn from childhood memories, thus explaining the unfamiliar in terms of the familiar and common, while Guido typically employs highly elaborate, extended, pseudo-logical, "argumentative" analogies as a means of self-justification.

Though Browning's imagery in The Ring and the Book as a whole may be characterized as highly sensuous, the poet very seldom uses imagery to comment on the sensuous aspects of the people and objects he is figuratively representing. More often, imagery is used to express the speaker's interpretation of events and his sympathies and prejudices concerning people.

Typically, the images in the poem have the characteristic structure and development of a logical analogy, and reveal in many other ways a strong intellectual and logical tone. Yet, thought never drives out feeling and imagination, for Browning employs image content having great sensuous, emotional, and imaginative appeal. Thought and

emotion are thus fused in Browning's imagery, contrary to the opinion of T. S. Eliot and others.

A comparison of Browning's imagery in The Ring and the Book with the imagery of Shelley, Donne, and Shakespeare shows some interesting similarities and some significant differences between Browning's imagery and that of each of the other poets. Browning was probably influenced most strongly by Shelley.

386 pages. \$4.95. Mic 56-3421

#### CHAUCER AS A PROSE WRITER

(Publication No. 19,294)

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The University of Tennessee, 1956

Major Professor: Roscoe E. Parker

Chaucer the poet so greatly overshadows Chaucer the prose writer that little interest has been shown in his four extant prose works: Boece, The Tale of Melibee, The Parson's Tale, and A Treatise on the Astrolabe. The purpose of this dissertation has been to study his prose works in order (1) to determine characteristics of his style, (2) to study stylistic relationships among the works, and (3) to determine whether or not Chaucer has a place in the continuity of English prose.

To make such a study, it is necessary to know three general characteristics of fourteenth-century prose: (1) Latin works, which influenced English literature, had a general literary quality in subject, style, and purpose. Thus the fourteenth-century English translator who adopted these literary characteristics wrote English literary prose. (2) There was an increased use of English for such practical purposes as wills, legal records, official documents, and sermons. Thus English appealed to unlearned Englishmen, adapted its style to their needs, and served the spiritual demands of the English preacher. (3) English prose assumed a utilitarian purpose of instruction in the schools and was used for scientific writing. On the basis of these classifications, Chaucer's prose is both literary and practical: Boece is literary in subject, form, and purpose; Melibee is literary in form and practical in purpose; Parson's Tale is practical in form and purpose; and Astrolabe is practical in form and utilitarian in purpose.

The conclusions of this study are as follows: (1) Chaucer adapts his style to the subject, purpose, and intended audience. Boece uses rhetorical devices and has a sentence structure that is involved and complex; Melibee also uses rhetorical devices, but has clear sentence structure; Parson's Tale uses short sentences and some rhetorical devices of the oral tradition; Astrolabe uses elements of practical prose and rhetorical devices for the purpose of instruction. (2) Chaucer uses similar stylistic techniques in the four works, but the differences of subject, purpose, and intended audience show that he does not make definite progress from the involved structure of Boece to the simple and clear sentences of Astrolabe. Nor is the use of literary and rhetorical devices a constant trait of his prose style. It is the conscious artistry of Chaucer that remains stable: he is more than a

translator, for in each work he adapts his style to his audience, purpose, and subject. (3) Prose of the preceding and succeeding centuries shows that English prose develops in two traditions--translations and native prose. Thus Chaucer's prose translations place him in the continuity of English prose. The study has shown further that his prose had significance to his contemporaries and that the decline of his reputation as a prose writer in later centuries is not the result of inadequacy of the translations but of (1) a change in taste for the subjects about which he wrote, (2) changes in the language which have made his English difficult for the modern reader, (3) frequent failure to realize that the oral technique was the traditional method for transmitting literary works in the Middle Ages, and (4) the failure to recognize that Chaucer was writing in a time when the English language did not have the smooth perfection and flexibility that it has today.

294 pages. \$3.80. Mic 56-3422

#### LANGUAGE AND LITERATURE, CLASSICAL

IAMBULUS: A LITERARY STUDY  
IN GREEK UTOPIANISM

(Publication No. 19,259)

David Winston, Ph.D.  
Columbia University, 1956

In a full-length study of Iambulus, we have attempted to classify his utopian Islands of the Sun more accurately than was done hitherto, and to indicate briefly its literary antecedents. We have found it to be a voyage extraordinaire, or a utopia written in the form of a realistic sea voyage and aiming at authentication. This form had already been used by Hecataeus of Abdera in his *περὶ Τηρεβορέων* and Euhemerus of Messana in his 'Ιερὰ Αναγραφή'. The many writers who have taken Iambulus' narrative to be authentic and have extracted geographical and historical information from it are sufficient to prove that the above classification is correct. Turning to the problem of content, we have endeavoured to show that the Islands of the Sun are an unmistakable example of "Cockaigne" utopianism, which is not content to transform the social order alone, but seeks to transform the natural order as well. This imaginative flight may be traced in such early forms of literature as the following: Paradise, Fairy Paradise, Golden Age, and Cockaigne. (Chapter One offers a brief survey of these forms of literature in Greece.) It is obvious, then, that the Cockaigne element removes Iambulus' utopia from the realm of serious philosophical speculation and attempts to identify it with any one philosophical school are unjustified. Pöhlmann, Tarn, and Visser have approximated this point of view without offering clear-cut classifications or analyses of them.

Although previous estimates of Iambulus' date have generally put him somewhere between 290-50 B. C., we have endeavoured to show that a range of 165-50 B. C. is more likely. Although the evidence is inconclusive, we have attempted to show that not Eratosthenes but Panaetius

and Polybius were the earliest exponents of the theory of a temperate equatorial climate, as Berger had already pointed out. Since Iambulus reflects this theory he must be later than c. 165 B. C. A possible allusion to the Ganges delta by Iambulus unfortunately leads nowhere, though it suggests a later date.

A summary of Iambulus' sources reveals his heavy leaning on travel narratives of India, the Greek utopian tradition which preceded him, and various philosophical works. There is a marked emphasis on astronomical data, as a result of Iambulus' efforts at authentication. The very accurate and well-known *Παράπλον* of Nearchus contained much astronomical and meteorological information and it must have exerted a strong influence on any writer trying to simulate an Indian ocean voyage. There are even linguistic similarities between Iambulus and the current astronomical terminology of his age.

Finally, we have shown that Iambulus' utopia had a distinct influence on Campanella's *Città del Sole* (1623) and Gabriel Foigny's *Terre Australe Connue* (1676). Both authors may have read Iambulus either in Ramusio's Italian translation, or in the French rendering of Ramusio's version. Iambulus is thus an important link in the development of the utopian literary tradition.

136 pages. \$1.80. Mic 56-3423

#### LANGUAGE AND LITERATURE, LINGUISTICS

##### LE ROMAN DE FLAMENCA, TRANSLATED FOR THE FIRST TIME COMPLETELY INTO ENGLISH VERSE, FROM THE THIRTEENTH CENTURY OLD PROVENCAL, WITH A CRITICAL INTRODUCTION

(Publication No. 16,931)

Franklin Osborn Cooke, Ph.D.  
University of Colorado, 1955

Supervisor: Professor Stuart Cuthbertson

Flamenca, a thirteenth century Old Provencal *roman d'aventure* in verse, exists in a unique manuscript fragment of 8095 lines, with beginning and ending missing, now in the *Bibliotheque municipale* of Carcassonne. Previous versions in English and French have been in prose, bowdlerized, incomplete, and not based on the original. This translation, in verse, aims to recapture the interplay of tonality and idea necessarily lost in previous prose versions, as well as to supply accurate interpretation of passages previously omitted or bowdlerized, through not consulting the original manuscript. The work deserves to be better known to all students of literature, for aside from its value to philology and literary history, it clearly anticipates both Chaucer and the modern novel. Contrary to the opinions of previous editors, it was not intended as a historical novel nor as a *roman de moeurs*. As a *roman d'aventure*, it lacks the usual weaknesses of the genre. Primarily a story and study of courtly love, it is a delicate mockery of both that impossible ideal and those of chivalry during the Crusades. As such it may well deserve to have been called "the first modern novel."

The unknown author combines rare skill in plot structure with a detailed knowledge of Ovid, the Bible, and a wide range of medieval writings, especially the *Roman de la Rose*. Calling himself Bernardet, and probably writing late in life, between 1272 and 1300, the author, who may also have been the scribe, intended this, his life work, to be read aloud serially to noble ladies in the hope of receiving a pension, or else to satisfy their demands for a *roman* which could connect them with the *haut monde* of late thirteenth century French society. The scene is naturally enough laid at Bourbon, the fashionable watering place, where these ladies of the lesser nobility of Auvergne would have met or seen the nobility herein described. Probably these ladies were of the de Roquetaillade family, whose chief chateau was at Algues, and who had been recently given greater social power and ambition by appointments to special local duties by Alphonse de Poitiers in 1270.

Close scansion of the manuscript reveals that the author had probably finished his work, with perhaps another 1200 lines missing at both beginning and end. He was in the process of smoothing his scansion by shifting from disyllabification to diphthongization, as is evidenced in interlineation and deletion. The language, as well as the basic plot, which bears great resemblance to the fabliau of the *Chevalier à la Trappe*, indicates greater affinity with Italian and Catalan sources than with Norman or French.

Historical, paleographic, and linguistic evidence indicates that the work is much more likely to have been written ca. 1300 than earlier in the century, as previous editors have claimed. 404 pages. \$5.15. Mic 56-3424

#### LANGUAGE AND LITERATURE, MODERN

##### ECCLESIASTICAL CHARACTERS IN THE NOVELS OF ENRICA VON HANDEL-MAZZETTI

(Publication No. 17,528)

Joseph Earl Bourgeois, Ph.D.  
University of Cincinnati, 1956

The problem of this dissertation is to examine comprehensively the characterization of Catholic priests, Catholic religious, Lutheran ministers, and Lutheran religious in the novels of the Catholic writer, Enrica von Handel-Mazzetti, and to formulate conclusions on the basis of the internal evidence thus acquired. The characters in question are worthy of special study because they play leading roles in Handel-Mazzetti's total novelistic work and in view of the fact that some of them have frequently been subjected to favorable and unfavorable criticism in the past. No one, up to the present time, has attempted to study them comprehensively, taking into account all the novels and the most significant criticism on the subject. Only two major works have touched briefly on ecclesiastical characters, viz. "Religiöse Probleme in Handel-Mazzettis vier religiösen Geschichtsromanen" (diss. Prague, 1925) by Adolf Buder, S.J., and "The Concept of Religious Tolerance in the Novels of Enrica von Handel-Mazzetti" (diss. University of Michigan, 1945) by Alcuin Hemmen, O.S.B. The first of these does not go beyond

Handel-Mazzetti's fourth novel, Stephana Schwerterner, and Father Hemmen is concerned primarily with the expression of religious tolerance on the part of all characters in general.

The present writer introduces the novelist through a brief biography and points out her importance to German Catholic literature at the turn of the century. He then proceeds to survey Catholic and non-Catholic reaction to Handel-Mazzetti's ecclesiastical characterization in three early novels, against the background of the German Catholic literary revival, the Los-von-Rom agitation, and Modernism. It is shown that the novelist's objective representation of priests, ministers, and religious in these early works was partially responsible for a stormy discussion of her art in Catholic circles, in which finally suspicions of heresy arose in regard to her writings. A timely recognition of Handel-Mazzetti by Pope Pius X and the efforts of friends and supporters helped to clear the novelist of these veiled charges against her Catholic orthodoxy.

For several reasons, but principally because the novels which followed Stephana Schwerterner are not primarily concerned with the religious struggle and conversion of the early works, the writer divides the novels into two groups for the purposes of this study. Only Die arme Margaret does not receive special attention because the two briefly treated ecclesiastics in it can hardly be considered characterizations. The story of each novel is presented in résumé form before the characters concerned are discussed. On the basis of the textual evidence, the writer formulates certain conclusions.

It is evident from the findings taken from the twenty volumes of novels that Handel-Mazzetti treated, in her rich variety of ecclesiastical characters, four major types. These are the exponent of charity, the militant priest or minister, the quiet unemotional ecclesiastic, and the cultured and aristocratic "Klosterfrau." It is further observed that some Catholic ecclesiastical characters reflect the mind of the Catholic Church in regard to extra ecclesiam nulla salus, the approach to conversion, and the question of guilt, while others do not. Protestant ministers also are represented as having conflicting views on conversion and guilt. Finally the evidence proves that Handel-Mazzetti depicts priests, monks, ministers, and nuns as very human characters, as they might occur in real life and subject to human frailty.

A by-product of this study is the compilation of a bibliography of works and reviews on Enrica von Handel-Mazzetti, which is a relatively complete list as of June, 1956. So far as is known, this is the first Handel-Mazzetti bibliography.

175 pages. \$2.30. Mic 56-3425

#### REMY DE GOURMONT, LITERARY CRITIC

(Publication No. 18,492)

Glenn Stephen Burne, Ph.D.  
University of Washington, 1956

The objective of this study is to characterize and explain the importance of Remy de Gourmont in the history of European literature and criticism, and especially to discover the unity of outlook which underlies his varied

activities as poet, novelist, literary historian, scientific theorist, and aesthetician. The thesis considers Gourmont's debts to the philosophic and scientific movements of his time, and demonstrates how he used what he learned from these sources, and from his own creative experiences, in formulating a set of critical principles; it analyzes Gourmont's concept of style, by which he drew together the varied strands of his thought, and notes the influence of this concept in English and American poetry and criticism.

A brief literary biography presents a chronological discussion of Gourmont's major works, the conditions of their creation, and summaries of their contents; it reveals the few significant events of Gourmont's personal life: his being fired from the Bibliothèque Nationale, his facial disfigurement, his friendship with Villiers de l'Isle-Adam, J.-K. Huysmans, and Mme. de Courrière, a Parisian occultist and follower of the Black Mass, the influence of these persons and events resulting in his withdrawal from society. As a bookish recluse he produced, in addition to the serious study of Medieval poets, Le Latin mystique, the erotic, perverse literature on which his early reputation was based: stories and dramas written in a precious, ironic style, stressing an interplay of idealism and carnality, religious faith and blasphemy, designed to demonstrate the subjectivist view of the world as "representation."

More important, however, were Gourmont's studies of contemporary philosophic and scientific theories, which provided the foundations of his theories of criticism and artistic creation: a combination of subjective idealism and skepticism which gave a rationale for his emphasis on freedom and originality in art and social conduct, and for his defense of the innovations of the Symbolist poets. These views were supported by Lamarckian science (the organ is created by the stimulus of the milieu), and current mechanistic psychology which stressed physiology as the source of personality: sensations, individual impressions of phenomena, transformed in the subconscious into sensory images, became for Gourmont the only "reality" and hence the only valid material of art. He evolved a "scientific" aesthetic which, in uniting intellect and body, made literature the product of the individual sensibility, amenable to no "rules" or literary conventions.

Gourmont's conception of style as the incorporating of the entire sensibility into language was adopted and modified by Anglo-American writers, especially members of the Imagist movement. Ezra Pound, Richard Aldington, and Amy Lowell were impressed principally by Gourmont's writings on freedom and individualism; Pound and F. S. Flint admired his poetry and discussions of le vers libre; Middleton Murry modelled much of his The Problem of Style on Gourmont's study of the same name; T. E. Hulme and T. S. Eliot were influenced by Gourmont's defense of the integrity of art, and by his theories on style and language. Eliot's early criticism, especially that of the seventeenth century English poets, displays considerable influence of and admissions of indebtedness to the works of Gourmont: Eliot's "sensuous thought" and "dissociation of sensibility" compare interestingly with similar concepts of Gourmont. These affinities between Gourmont and the Anglo-Americans are explored in order to demonstrate how Gourmont made writers more sharply aware of the relations between tradition and experiment, and how he

helped critics and poets to realize the psychological and physiological bases of their activities.

233 pages. \$3.05. Mic 56-3426

### THE THEME OF HUNGER IN THE SPANISH PICARESQUE NOVEL

(Publication No. 17,463)

Wallace J. Cameron, Ph.D.  
State University of Iowa, 1956

Chairman: Associate Professor Ruth Davis

Picaresque literature offers a wide range of social groups and individuals who are touched by the agony of hunger. Its pages teem with victims, famished students, prisoners, soldiers, gypsies, beggars, hidalgos, misers, paupers, servants, poets, spendthrifts, prodigals and, of course, pícaros.

Writers of the picaresque had no ample vision of a bountiful world where all might live with plenty. They took limited food production and its attendant inconveniences for granted. It is not surprising, therefore, that, in giving literary expression to the theme of hunger, they concern themselves very little with basic economic or agrarian causes. They deplore hunger although they regard it more stoically and dispassionately than would a man of the "age of abundance." They bring their attention to bear on a facet more suitable to literary treatment, the human frailties, aberrations and malevolence that lead men to inflict the agony on their fellows and on themselves. They direct their barbs at those who add to the difficulties of living in an age of scarcity.

Only in recent times has clinical research revealed the vital yet outwardly indiscernible effects of hunger on the physical structure. Quite naturally, then, even the more observant writers of the picaresque treat physical ravages in a conventional manner. But in the social and moral and, especially, in the psychological realm, they show a surprisingly particularized awareness of the havoc wrought on individuals and on society by the stresses of hunger. Their treatment is extensive and far-ranging in these areas where there is better material for complex literary purposes than in the purely physical aspect.

In the great creative period of the sixteenth and seventeenth centuries hunger moved from its position as a drab accompaniment of the daily lives of too many to a prominent place in the world of literature. It assumed an aesthetic function, became an important feature of the picaresque novel of Spain.

Hunger is poetized in the picaresque in various ways. It may be heavily concentrated as in the Lazarillo or it may be given emphasis by a deliberate selection of hunger scenes. In this way the bitterly pessimistic Aléman helps to create his sombre world. In both the Lazarillo and the Guzmán hunger is a symbol of the pain which is man's portion in his struggle to survive in a harsh world, and in the Guzmán it is a potent factor in character change. The theme lends itself to parody in the sequel to Lazarillo and to burlesque in Estebanillo. It is an excellent vehicle for caricature, exaggeration, grotesque treatment and cruel wit in the hands of a master such as Quevedo. It is often

the occasion of scenes of drama, poignancy and pathos. It almost universally furnishes a means of satire. In La desordenada codicia it serves to create a scene of sheer horror. The treatment need not be dismal. It may be lightened by humor as in Marcos de Obregón and El donado hablador. And Cervantes achieves a truly comic effect with his animal pícaro. The one woman writer of the group provides the only consistently light-hearted treatment. And compassion is most evident in the story from the pen of Cervantes.

Since hunger is basically a calamity, an unlovely thing, writers of the picaresque are under the necessity of handling pain, evil and ugliness. The effect produced is the result not merely of the harsh, sometimes repellent scenes and emotions, but of the art with which these are portrayed. If the art pleases, then the evil and pain are lifted to beauty, become what Warren calls "difficult beauty" with intricacy, tension and width.

213 pages. \$2.80. Mic 56-3427

### THE SATIRES AND SATIRICAL COMEDIES OF JOHN MARSTON

(Publication No. 19,154)

Anthony Francis Caputi, Ph.D.  
Cornell University, 1956

John Marston's brief literary career began when he abandoned the law to join the new generation of literati in London. Their influence accounts in part for Marston's work in Pygmalion's Image, Certain Satires, and The Scourge of Villainy. These poems are especially important, however, for what they reveal of Marston's ambition to elevate the stature of satire by bringing to it an artistry more impressive than that usually associated with the genre.

The satires, particularly, trace Marston's apprenticeship in the techniques and style that were to form so large a part of his dramatic art. In them he exposed folly and vice in character sketches and exempla and combined this derision with didacticism. Moreover, he perfected the harsh and obscure satiric style then thought appropriate to satiric utterance and combined all these elements in individual poems controlled by theses and within a general plan controlling the whole. When Marston turned to satirical comedy, he chose the path of least resistance by first reworking the old Histriomastix, a play suited to accommodate the techniques worked out in the satires.

But Marston's achievement cannot be satisfactorily clarified unless the external circumstances that influenced him are also taken into account. It is important to recognize that he wrote all his plays for the private companies at Paul's and Blackfriars and that the rivalry between these companies and the public companies determined his satire in many ways. It is important, too, to evaluate his quarrel with Jonson and the extent to which it affected his plays. It is most important, however, to understand that he wrote for the child actors and that their limitations and special talents had a profound influence on his plays. Recognizing that the children were incapable of intense emotional power and complex character portrayal, the children's playwrights, including Marston, consciously

avoided plays beyond the child actors' talents in favor of plays that made the most of their skills in song and dance and, especially, of their innate capacity for broad burlesque. Only by assuming a burlesque acting style does Marston's unusual treatment of the lovers-in-distress plot in Jack Drum's Entertainment and Antonio and Mellida become intelligible. These plays combine the structural features necessitated by the child actors with the techniques worked out in his satires.

But Marston's next satirical comedies--What You Will, The Malcontent, and The Fawn--represent his fullest exploitation of the genre. In general, the success of these plays can be traced to Marston's use of the disguise plot which enabled him to integrate the grotesque fictional worlds of his plays and the satire and criticism with a clarity and comic power that he had not achieved previously.

His final efforts in Eastward Ho and The Dutch Courtezan represent separate attempts to repeat his success with still another kind of plot. Under the influence of Jonson and Chapman, he apparently perceived the suitability of a plot constructed to develop contrasts in character for the kind of comedy he was disposed to write, and in The Dutch Courtezan he tried his hand at it. Yet even in this play the continuities that unify all of Marston's work in satire and satirical comedy are evident.

In general, this study of Marston attempts to describe Marston's work in satire and satirical comedy by tracing the continuities and discontinuities all along the line. The critical approach taken, accordingly, is rigorously formal, except for occasional excursions into biography and literary and theatrical history. In the larger of the two Appendices a fresh attempt has been made to solve the numerous problems of canon.

324 pages. \$4.15. Mic 56-3428

bastard; it is comparable to illustrations given in L. F. Day, Penmanship of the XVI, XVII, and XVIIIth Centuries, plate 48, and Emilio Catarelo y Mori, Diccionario biográfico y bibliográfico de calígrafos españoles, I, 10.

The Deffensa de Poesia is a version of Sir Philip Sidney's Defence of Poesie, also known as Apologie for Poetrie. Editions of both English titles were first published in 1595, the Defence by William Ponsonby, London and the Apologie by Henry Olney, London.

The Deffensa corresponds more closely to the Defence of Poesie than it does to the Apologie for Poetrie, but it in turn varies from the Defence to about as great an extent as the Defence and Apologie differ from each other.

Quantitative variations between the Deffensa and the Defence of Poesie made necessary a discussion of authorship and date of composition. The following authors were surveyed-- Percy Addleshaw, Henry Richard Fox Bourne, John Buxton, Emma Marshall Denninger, Kenneth Orne Myrick, Malcolm William Wallace, Mona Wilson, and Thomas Zouch. Of these, Wallace is the only reliable source. The following three works, all primary, even to the works listed above, were also consulted: William Aspenwell Bradley, ed. The Correspondence of Philip Sidney and Hubert Languet (Boston, 1912), Arthur Collins, ed. Memoirs of the Lives and Actions of the Sidney's (London, 1746), and Sir Fulke Greville, The Life of the Renowned Sir Philip Sidney (London, 1652). Conclusions of Sidney scholars, based upon internal evidence, generally place the date of composition of the Defence of Poesie in 1580-1583. Evidence is adduced in the present dissertation from primary sources that Sidney knew Spanish, possibly well enough to have composed the Deffensa.

The Deffensa reads: "Quando el uirtuosissimo .N. y yo estuimos iuntos en la corte del Imperador ...." (1r), while the Defence runs: "(W)hen the right vertuous E. VV. and I, were at the Emperours Court togither ...," Noel Douglas, ed. Sir Philip Sidney, The Defence of Poesie, 1.

Possible solutions to the '.N.' vs. "E.W." disparity are (1) that the scribe used '.N.' to indicate anonymity of the referent; (2) that the scribe was a man whose patronymic initial was '.N.' and who wished to associate himself with Sidney, with or without historical justification; (3) if the author of the Deffensa were Sidney, that he recalled a Vienna associate named 'N', a recollection that would be historically justified.

The Deffensa says that Julius Caesar had been dead 1616 years (22r); the Defence says 1600 years have passed, Douglas, 24. Discussion and resolution of these and analogous disparities lead to the conclusion that the source of the Deffensa was not the same as the source of either the Defence or the Apologie. The disparities, added to linguistic comparisons of the Deffensa and the Defence and external historical evidence give reason to conclude (1) that the portion of the work containing '1600 & 1616' was composed earlier than the date generally conjectured for the composition of the Defence; (2) that either an Englishman or a Spaniard could have produced the Deffensa; (3) that Philip Sidney could have produced the Deffensa.

The Deffensa is compared to the Defence on levels of phonemics, morphology, and syntax. The Deffensa in diplomatic edition is presented parallel to the text of the Noel Douglas reprint of the Defence.

333 pages. \$4.30. Mic 56-3429

#### DEFFENSA DE POESIA: A SPANISH VERSION OF SIR PHILIP SIDNEY'S DEFENCE OF POESIE

(Publication No. 17,594)

Dwight Chambers, Ph.D.  
University of Kansas, 1956

The anonymous manuscript Deffensa de Poesia, MS 3908 of the Biblioteca Nacional de Madrid, consisting of sixty pages fifteen and one-half by twenty-two and one-half centimeters inscribed recto and verso and numbered consecutively recto, is produced in diplomatic edition from a negative microfilm copy made for the University of Kansas in August 1955. Bartolomé José Gallardo, Ensayo de una biblioteca española de libros raros y curiosos, II, 129, lists it under the signature M-119. Juana de José Prades, La teoría literaria, 9, says of it [sic]: "Es una apología de la poesía. En los capítulos 15 y 16 (fols. 26r y 29r) trata de algunos géneros poéticos. El manuscrito no tiene fecha y su autor, anónimo, dice haber estado en la corte del Emperador [Carlos I]." Cursive legends on 56v and 60r say that an owner of the manuscript was Dn Juan de Bustamente. Ramón Paz, personal letter (Madrid, February 25, 1956) says: "De la procedencia de este manuscrito no poseemos antecedentes en la Sección."

The handwriting of the manuscript is in style Spanish

**CONVERSATION PIECE: FOUR TWENTIETH-CENTURY  
ENGLISH DIALOGUE NOVELISTS**

(Publication No. 19,236)

Beekman Waldron Cottrell, Ph.D.  
Columbia University, 1956

This study has a twofold purpose. First, it is an attempt to define the genre of contemporary English novel known as the novel in dialogue, and to do so by stating certain characteristics common to such novels. The type is further defined by means of contrast with another kind of organized dialogue, the play. Second, Conversation Piece shows the range and diversity of the modern dialogue novel by examining carefully four of its practitioners: Aldous Huxley, Ronald Firbank, Henry Green, and Ivy Compton-Burnett.

After a brief survey of the backgrounds of the dialogue novel, it is shown that each of the four writers chosen approaches the dialogue novel in a different way. For Huxley, the conversation piece is a form which he used early in his writing career to present the cerebral complexities of the modern world. His early novels are intellectual vehicles in the Peacock manner, with characters standing for attitudes toward life. Ronald Firbank uses the technique as an impressionist--either in painting or music --might, to create shifting moods and mental climates and to present the reader with stimulating sensual experience. In his dialogue pieces, Henry Green has made use of a completely opposite approach. His material is as ordinary and fully in view as life itself, and from this experience--which is entirely in dialogue--he fashions pictures of contemporary life and spirit.

The novels of Ivy Compton-Burnett form the greatest and most consistent bulk of work in the dialogue form in contemporary English fiction. Her aim is for a more rounded, more complete picture of life than any of the other three novelists either strives for or achieves. By means of conversation she creates character, builds suspense and plot, and, finally, fashions a profound and lasting picture of human beings in sorrow, joy, or conflict. Though her settings are late Victorian, her attitude of mind is modern in that she deals with a world fully aware of Freud, Darwinian evolution, and the complexities of science. Compton-Burnett's technique is examined in some detail, and the claims to greatness in her novels are assessed.

A concluding chapter shows that the dialogue saturation in modern fiction is increasing, that the material of dialogue is being treated ever increasingly with respect and finesse, and that this growing emphasis upon dialogue in the novel may well reflect a culture which is steadily becoming more oral as the developments of science increase the range of vicarious experience.

168 pages. \$2.20. Mic 56-3430

**A GUIDE TO THE TEACHING OF RUSSIAN MILITARY  
TERMINOLOGY TO U.S. MARINE CORPS PERSONNEL**

(Publication No. 17,222)

Major Edward F. Danowitz USMC, Ph.D.  
University of Pennsylvania, 1956

Supervisor: Dr. Alfred Senn

The marine corps, as well as other branches of the service, has within its organization officers and enlisted men who have been provided with Russian language training at the various military language schools. These persons are not always afforded the opportunity of serving in billets utilizing this language upon completion of schooling due to priority of their primary specialties. The problem of maintaining practice and proficiency is nevertheless one which must be resolved by that individual in order to permit utilization of this language background when so ordered and required.

"A Guide to the Teaching of Russian Military Terminology to U. S. Marine Corps Personnel" has been prepared with these officers and enlisted men in mind. By properly making use of the material contained therein an opportunity is afforded to maintain the original level of proficiency and to improve upon that level by new additional learning. A secondary purpose of this work is to provide general unclassified knowledge of the marine corps to desirable groups, familiar with the Russian language, in time of desire.

To permit fulfillment of this purpose selected material was prepared in a form that will give language practice and at the same time permit development of the knowledge of the language in the professional field of the user, the military field.

The contents of this dissertation, divided into twenty chapters, each deal with an individual military subject and include within their content: a reading text of approximately 700 words in the Russian language relating to each subject; a military vocabulary of approximately 60 words, containing those new military terms utilized in the text; exercises following each vocabulary, which permit the user to review terms and grammar forms as well as to serve as a test of accomplishment.

The topics selected were those that would be of most common interest and importance to the marine corps, observing however all principles of security, and include the following: The organization of the Department of Defense of the U. S. A.; the organization of a marine infantry division; uniforms and equipment; ranks and insignia; functions of infantry and other special organizations; rifle marksmanship; the mortar; tanks; the functions of the tank crew; aviation; artillery weapons and shells; the manner of conducting artillery fire; principles of offensive and defensive combat; types and characteristics of naval vessels; atomic warfare; amphibious warfare, etc. Within each text charts of nomenclature (M1 rifle, mortar, jet aircraft etc.) are included wherever practicable.

In addition, a grammar supplement has been provided to explain certain forms encountered in the text and to provide for a review of those rules of grammar which present the most difficulty to the American using the Russian language. This supplement is not intended as a complete study of the Russian language but within its 56 pages does include treatment of the following: Nouns, their uses

in the various declensions as well as the rules of declension; declension and the uses of the various pronouns; declension, use and comparison of adjectives; uses and comparatives of adverbs; formation, usage and declension of participles; uses, formation and features of the gerund.

To direct proper attention to certain rules each paragraph in the supplement is numbered. Forms in the text requiring explanation bear similar numbers permitting ready access to the proper section of the supplement.

Completion of the exercises gives practice in the translation of the text from Russian into English; the answering of certain questions, pertaining to the text, in Russian; and, translation of English texts, utilizing the new terminology, into Russian.

This work will therefore provide the U. S. Marine Corps with material that can assist Russian language personnel, who are not actually serving in billets utilizing this background, to maintain their language proficiency and to study applicable military terminology in an interesting, expeditious manner. 198 pages. \$2.60. Mic 56-3431

#### THE THEME OF LONELINESS IN MODERN AMERICAN DRAMA

(Publication No. 17,548)

Winifred Loesch Dusenbury, Ph.D.  
The University of Florida, 1956

Written with the supposition that the theme is vital to the structure of a drama and to its meaning, the dissertation establishes the theme of loneliness as one of the most important in the serious American drama of the period 1920-1950. Loneliness is defined as a "suffering self-recognition of separateness," which is shown to be prevalent in American life, as well as in the drama, thus reinforcing the idea that drama is a reflection of life.

Books such as David Riesman's The Lonely Crowd, from the sociological, and Erich Fromm's Man for Himself, from the psychological viewpoint, explain the loneliness of modern man. Numerous articles by such literary figures as Thornton Wilder and Thomas Wolfe point up the American's sense of loneliness. An important American playwright, Elmer Rice, lists loneliness first among themes common in modern American drama, and the outstanding dramatic critic, Brooks Atkinson, claims, "In the mystique of today loneliness is a relevant subject."

Twenty-six plays by modern American playwrights in which the theme of loneliness plays an important part are considered in detail. They are grouped by chapters according to the playwright's presentation of the basic cause of loneliness: personal failure, homelessness, lack of normal family relationships, failure of a love affair, socio-economic forces, and conflict of the spiritual with the material. The last chapter is concerned with the modern interpretation of the lonely hero.

The study establishes the broad scope of the theme of loneliness as it applies to the various classifications of dramas from realism to symbolism; as it applies to the large number of playwrights of differing "philosophies" who have made use of it; and as it applies to the variety of characters of various ages, economic conditions, and geographical locations who are involved. In plays like William

Inge's realistic Come Back, Little Sheba and in William Saroyan's surrealistic The Time of Your Life the theme of loneliness influences the action. Playwrights as different as Eugene O'Neill and Clifford Odets or as Robert Sherwood and Tennessee Williams have found the theme of loneliness meaningful. Characters as different as Carson McCullers' adolescent Frankie in The Member of the Wedding and Arthur Miller's Willy Loman in Death of a Salesman suffer from a self-recognition of separateness.

The study explains the effect of the theme dramaturgically in the case of each of the plays discussed, with some conclusions drawn as to the general effect on all. Consideration is given to the influence of the theme on the forward movement of the play; on the inner conflict of the characters as expressed in overt action; on the dramatization of loneliness through the failure of characters to be able to communicate with each other; on the growth of characters toward a state of belonging or toward complete isolation; on the use of analogous minor characters as reinforcement of the theme of loneliness; on the aesthetic effect of tragedy or pity aroused by the plays discussed; on the unification of action, form and purpose induced by the theme; and on the use of modern technical practices of staging to reinforce the theme.

The findings of the dissertation are, briefly, the establishment of the causes of loneliness as interpreted by modern playwrights, the delineation of the broad scope of the theme, the analysis of the dramaturgical effect on the individual plays considered, and the explanation of the relationship of the theme, as used in drama, to American life.

357 pages. \$4.60. Mic 56-3432

#### THE RELATIONS OF NOVALIS TO MATHEMATICS

(Publication No. 17,531)

Martin Dyck, Ph.D.  
University of Cincinnati, 1956

In this dissertation Novalis' fragments on mathematics are elucidated with special emphasis on the mathematical and philosophical thought in the eighteenth century.

Chapter I deals with the sources and previous research. Novalis has been represented by his critics as the apostle of night and death, and has been so enshrouded by them in nebulous mysticism that scholars found it almost impossible to dispel the magical aura surrounding him, and to evaluate soberly his fragments on mathematics. Hence previous scholars either ignored these fragments, or dismissed them as nonsense, or exaggerated their significance by detecting in them an adumbration of the theory of relativity, or simply admitted that for various reasons they were unable or unwilling to deal with them. The only previous study exclusively devoted to the subject is Käte Hamburger's article "Novalis und die Mathematik," Romantik-Forschungen (Halle, 1929). She deals adequately with Novalis' conception of function, continuity, infinity, time, and space, but omits from her discussion numerous other fragments on mathematics. She does not adequately relate Novalis' fragments on mathematics to their historical setting, but is unduly influenced by the critical distinctions of the Neo-Kantian school (Cohen, Natorp, Cassirer).

In Chapter II the methods of eighteenth-century mathematicians are shown to be experimental and unrigorous from the modern point of view. Like Novalis, these mathematicians associated mathematics with philosophy, religion, and other non-physical branches of knowledge. This chapter also includes an estimate of his knowledge of mathematics based on a discussion of his mathematical training and his teachers and associates in the field. Points of contact are established between Novalis' fragments on mathematics and Kant's *Kritik der reinen Vernunft*, Euler's *Institutiones calculi differentialis*, and other philosophical and mathematical sources.

Chapter III deals with Novalis' informal treatment of such basic mathematical concepts as definition, axiom, theorem, proof, and other concepts of geometry, arithmetic, algebra, and analysis.

Chapter IV is devoted to Novalis' projection of mathematical concepts into fields of knowledge other than the physical sciences. Novalis regards mathematics as the ideal science and intends to use it as a unifying principle in his contemplated universal encyclopedia of knowledge. His first step towards this goal is to mathematize all branches of knowledge. This chapter therefore deals with Novalis' thought on the relation between mathematics and philosophy, magic, religion, language, literature, and music.

In conclusion, it may be said that Novalis was acquainted with most mathematical results and discoveries of his time. He did not concentrate on strict mathematical research, but strove for a universal mathematics in the line of Descartes' search for a "mathesis universalis" and Leibniz' search for an "arithmetic universalis." He made no contribution to the progress of the formal science of mathematics, but was concerned with an extension of its boundaries beyond its usual domain.

181 pages. \$2.40. Mic 56-3433

**THE USE OF THE ARTS OF DECORATION  
IN EDITH WHARTON'S FICTION: A STUDY OF HER  
INTERESTS IN ARCHITECTURE,  
INTERIOR DECORATION AND GARDENING AND OF  
THE LANGUAGE IN WHICH SHE EXPLOITED THEM**

(Publication No. 19,088)

Alphonse Joseph Fritz, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Frederick J. Hoffman

The decorative arts lie in what Edith Wharton called "the great undefinable domain of taste." The essence of taste is suitability or, synonymously, fitness, proportion. These are the standards of judgment Edith Wharton applied to architecture and décor in *The Decoration of Houses*, to gardening in *Italian Villas and Their Gardens*, to life in general in her travel books. Analogically, they are the basic terms of her literary criticism and determine the propriety of what goes into a work of fiction.

In the fiction of Mrs. Wharton's apprentice period--from "Mrs. Manstey's View" (1891) to *The Valley of Decision* (1902)--her preoccupation with architecture, interior decoration and gardening, with dress, cuisine,

linguistic expression and the rules of social intercourse affects her fiction chiefly as a quality of language. It expresses itself in carefully chosen modifiers, which not only describe, but project attitudes, in epigram and figurative language which have their source in the decorative arts.

To see reality through the medium of art becomes a method in this early fiction. Although this curious reversal of sensibility remains an invariable characteristic of her fiction, Edith Wharton learned to conceive of seeing as an act of the inner more than of the outer eye; to exploit her interest in the decorative arts through the Jamesian *séance à faire*, and not merely to project the luminous surfaces of life but to interpret their significance. But the pictorial and scenic method to which she explicitly called attention in *The Valley of Decision* predominates over the dramatic in her early fiction.

*The House of Mirth* (1905) marks the beginning of Edith Wharton's "major phase," which ended with *The Age of Innocence* (1920). In this period her exploitation of the arts of decoration becomes a thematic concern. With *The Fruit of the Tree* and *The Custom of the Country*, it examines the late nineteenth century American scene as "the gilded age of decoration." The ruthless accumulation of wealth, a dull subservience to luxury without personal distinction, and an unslakable thirst for novelty are its characteristics.

Simultaneously, *Madame de Treymes*, *The Reef*, and *The Age of Innocence* dramatize the values, esthetic and moral, of a rich European cultural heritage. The decorative background has a moral extension--"a kind of conformity in inanimate things." It forms the descriptive base of an ingenious structure of exposition, narrative, and dialogue, all functioning organically and given extension of awareness through iterative imagery, metaphors, and tone colors. A number of fine dramatic scenes not only present their own central situations, but contribute to the décor and main design of these novels.

Edith Wharton's use of the arts of decoration is an instructive point of view from which to examine her fiction of the 'twenties and 'thirties because it helps to explain its persistent weakness and occasional strength. Her conviction that this was a time when manners, having been efficiently Taylorized out of existence, no longer made themselves felt through the decorative arts helps to account for the degeneration of her style. And this use reveals why the degree of sympathy she accorded to the characters of her late fiction depended upon their cultural alignments--their devotion to or rejection of the past. The "rich low murmur of the past" heard by Annabel St. George of *The Buccaneers* becomes a principal thematic concern of Mrs. Wharton's later fiction. *The Buccaneers* proves that Edith Wharton never really forgot Henry James's passionate conviction that in art what is merely stated is not presented, what is not presented is not vivid, what is not vivid is not represented, and what is not represented is not art.

310 pages. \$4.00. Mic 56-3434

THE GREEK ROMANCE MATERIALS  
IN THE PLAYS OF SHAKESPEARE

(Publication No. 17,442)

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Louisiana State University, 1956

Supervisor: Professor William John Olive

The interest in Greek letters which formed a major element in the intellectual milieu of the Renaissance resulted in frequent publication of the Hellenistic romances of Apollonius of Tyre, Heliodorus, Longus, and Achilles Tatius in Greek and in Latin and vernacular translations. Recognition was also made of the romances of Chariton and Xenophon of Ephesus as extant in manuscript. Dr. Samuel Lee Wolff in The Greek Romances in Elizabethan Prose Fiction demonstrated the profound influence of the publication in English translation of Heliodorus, Longus, and Achilles Tatius on the Elizabethan novel; this dissertation was planned as an inquiry into similar influence on Elizabethan drama through investigation of the presence of Greek romance materials in the plays of the central figure of the age: William Shakespeare.

Although they had a wide circle of readers during the Renaissance, the Greek romances are not well known today, even by Classical scholars. For this reason, and because Dr. Wolff confined his study to only three, the present study considers all the extant Hellenistic romances of the type defined as Sophistik by Erwin Rohde in his Der Griechische Roman und Seine Vorläufer as individual works and in relation to their genre, its genesis, development, and decadence. Thus, the study falls into two major divisions. Chapters I and II are a fairly detailed treatment of the romances; Chapters III and IV demonstrate the presence of romance materials in Shakespeare's plays. An appendix tabulates their publication in Greek and in Latin and western European vernacular translations up to 1642. It serves as a body of evidence upon which to base conclusions as to their accessibility to Shakespeare.

Through summaries and quotations, evidence is presented to show that plot materials for The Comedy of Errors, Romeo and Juliet, Much Ado About Nothing, As You Like It, Twelfth Night, King Lear, Pericles: Prince of Tyre, Cymbeline, The Winter's Tale, and The Tempest are derived from the Greek romances; that Two Gentlemen of Verona, A Midsummer Night's Dream, The Merchant of Venice and Othello have verbal or incidental elements which apparently have Greek romance affinities; and that the Birnam Wood episode in Macbeth has an analogue in Achilles Tatius. The most important conclusions are that Cymbeline is a conscious imitation of the AEthiopica of Heliodorus; that Daphnis and Chloe of Longus is a primary source of The Tempest; and that pastoral elements of As You Like It, Cymbeline, The Winter's Tale, and The Tempest all derive ultimately from Daphnis and Chloe.

An over-all view of the evidence brings the final conclusions that for the plays written before Pericles: Prince of Tyre (c. 1607 - 1608), the Greek romances were a strong minor influence on Shakespeare, possibly direct in some instances, but probably in most cases derived from Greek romance elements in the general literary and intellectual milieu of the Renaissance; and that they were a major influence, an all important source of materials of composition and romantic atmosphere, in Pericles: Prince

of Tyre and the romantic comedies which followed and concluded Shakespeare's dramatic career, Cymbeline, The Winter's Tale, and The Tempest.

352 pages. \$4.50. Mic 56-3435

JOHN MUIR'S VIEWS OF NATURE  
AND THEIR CONSEQUENCES

(Publication No. 19,093)

Edith Jane Hadley, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harry Hayden Clark

John Muir's life has a unity revealed by discovery of the relation between his romantic views of nature and his practical work for conservation. This dissertation first tells how his concept of nature developed through reading, travel, and wilderness experience and by friendships with poets, scientists, teachers, and editors of his day, with whose varying compromises between science, religion, and a romantic view of nature he became familiar. It next surveys his campaign to save a part of the wilderness, behind which his views of nature, earlier formed, were the directing force.

Muir's non-utilitarian view was partly a reaction against his early environments. As a boy he participated in "conquering" the wilderness, observing the unintelligent use of nature by the neighboring Scotch, English, and Irish pioneers. Spurred on by an ingrained fear of want, the result of a poverty-stricken background (like Dunbar, Scotland, Muir's birthplace) these families and those he knew later in Canada risked health and sanity in a struggle to convert forests or other natural utilities into cash.

He saw how the orthodox religion of his father and others was allied to such destruction of the wild. Founded entirely on Biblical "revelation" this Calvinistic creed considered man the center of the Universe with a God-given right to exploit nature, animate and inanimate. To Muir such a faith was a travesty of nature's truth and beauty. Nevertheless, influenced by machine age goals he began to turn his manual skill and knowledge of applied science into material gain until his nature philosophy predominated making him forego such worldly aims. His views of nature first took shape vicariously through reading eighteenth and nineteenth century poets with their primitivistic ideas of Nature's beneficence and man's degeneracy. At Wisconsin (1860-1863) Muir enriched his thought by study of natural science including evolution. Mrs. Ezra Carr, whose feeling for nature resembled that of her fellow Vermonters, James Marsh and George Perkins Marsh, helped Muir reconcile science with his religion and romantic views of nature. Writing to him after he left the University, she confirmed him in the metaphysical view which finds nature permeated and transcended by Spirit. Later Muir met Emerson who stimulated his reading of romantic and transcendental authors.

Professor Ezra Carr introduced Muir to the scientists, Amos Eaton, Carr's own teacher, Silliman, Wood, Agassiz, and Gray; later, in Yosemite Muir read Humboldt, Darwin, Huxley, and Wallace, and met Gray, Hooker, Tyndall, Torrey, Runkle, Osborn, and Sargent and many government

scientists. He was able partially to reconcile science with his romantic views of nature by interpreting "design" not as the plan of a Universe made for man but as one being formed for everything in it through the agency of a loving Spirit. Because of physical stamina and faith in Nature's divinity Muir met wilderness hardships optimistically, free from the pessimistic naturalism of his day, which he attributed to fear. Unfortunately, the "genteel tradition" of his editors checked a tendency toward vivid, realistic writing. His anger at the despoiling of nature was mainly a poet's unhappiness over transience of wild beauty perishing at the hands of insensate man, but his theory of conservation was a guide for action with values, aesthetic, spiritual, and even practical in the right sense.

New or little-known material used in this study consists mainly of Muir's books, his marginalia in them, 130 unpublished letters to Johnson and others to Le Conte, Emerson, Gray, William Kent, and William Colby. Conversation with those who knew Muir or whose fathers knew him, from ninety year old Wisconsin pioneers to writers and professional people of San Francisco and New York has been illuminating.

796 pages. \$10.05. Mic 56-3414

#### A STUDY OF NON-RATIONAL ELEMENTS IN THE WORKS OF HENRY ADAMS AS CENTRALIZED IN HIS ATTITUDE TOWARD WOMAN

(Publication No. 19,094)

Sister M. Aquinas Healy, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harry Hayden Clark

A study of non-rational elements in the works of Henry Adams as centralized in his attitude toward woman reveals a gradual and life-long conversion from the values of reason to those of "intuitive instinct." Many of Adams' themes fall into the pattern of woman-worship prevalent among American writers at the turn of the century. His woman-symbol represents intuitive instinct, lawlessness, and sexual force as opposed to reason, order, and law.

The woman-centered works present a consistent apotheosis of instinct, the "potential of vital energy." In the novel, Democracy, woman instinctively rejects a male-formulated, reasonable political faith; in Esther, the heroine repudiates an apparently logical system of Christianity in favor of an instinctive religion of "nature"; in Tahiti, primitive woman protects her people by instinctive action, averting a male-precipitated social disaster; in the Chartres, Adams' Virgin is deified as a symbol of all that is "illogical, unreasonable, and feminine," loving and forgiving, as opposed to logic, order, and law - divine or human; in the Education, Adams laments modern woman's repudiation of the natural instincts which once enthroned her at the center of the family and society, and the consequent partial deflection of sex inertia in a mechanized, industrial world.

The man-centered works reveal a concomitant skepticism and a deterministic philosophy based on the control of human destiny by forces of nature. The History records the inevitable failure of the a priori rationalism of

Jeffersonian popular democracy; the Gallatin describes a great statesman's loss of faith in the same rationalistic theory and his conversion to a philosophy of circumstance, blind force, and human caprice as the determinants of man's destiny; the Lodge depicts the inevitable defeat of artistic temperament by sterile environmental forces.

Henry Adams' last four works paradoxically plead for a rational, scientific theory of history, but conclude that chaos is the law of nature. Thus Adams reconciles a rational quest for the meaning of history and of life with his experiential acceptance of lawless intuitive instinct as the most satisfactory guide to existence. A Letter to American Teachers of History proposes that reason in modern man is only degraded instinct. Its term is an equilibrium of mere consciousness. According to the law of dissipation of energy, instinct and reason - like all forms of force - are destined to extinction. Adams' concept of "instinct" or "will" is partially akin to that of Schopenhauer, von Hartmann, and Bergson, among others. The Rule of Phase Applied to History traces the sequence of force in intense primitive instinct to equilibriums of debilitated reason. The Chartres and the Education illustrate the Rule. Adams' Virgin of Chartres is placed at the top of the historical graph of degradation as a symbol of the most dynamic phase of instinct. A supreme symbol of pagan woman-worship, she is antagonistic to the historical Virgin Mary and to medieval Christianity. At the bottom of the graph of degradation is the "manikin" Henry Adams, a symbol of the lowest phase of weakened instinct in the age of the dynamo.

In the bankruptcy of both reason and supernatural faith, Henry Adams glorified instinct. But that led nowhere finally. Woman's intuition taught more than reason, but it taught no final truth. Yet if the philosophical and historical journey of Adams led only to chaos, if neither reason nor intuition led to ultimate answers, the very conflict between heart and head gave fire to the creative imagination. And the unstable compound of obsessive iconoclasm and anguished yearning for something beyond materialistic naturalism helped to make his record of failure vibrate with tensions which give it human appeal and exceptional charm as literature. 662 pages. \$8.40. Mic 56-3436

#### ELIZABETH BOWEN AND THE TRADITION OF THE NOVEL

(Publication No. 17,314)

William Webster Heath, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Paul L. Wiley

It is argued in this study that the matter and manner of Elizabeth Bowen's novels are traditional--that she has accepted the subject matter and technical innovations of past novelists in order to reinterpret a contemporary world. To separate one manageable literary tradition from the unordered mass of past literature the theme of the "romantic will" has been used as a common denominator. Basically, novelists concerned with the romantic will present a protagonist, usually a young girl, who innocently projects an ideal world around her (in this sense she is

romantic); at the same time she believes she can determine her own actions in terms of this ideal world (in this way will is involved). The action of a novel of this type exists in the conflict between this ideal projection and the reality of circumstance (the mores of society, the wills of other people, the physical "facts" of existence, fate). Thus the belief that "feeling" can be realized directly in action must somehow be reconciled to the knowledge that it cannot.

Since the belief is an historical constant, the extent of knowledge a variable, the manner in which the conflict is presented will be partly determined by the "climate of opinion" in society as a whole. Primarily for this reason, writers have been selected for discussion from different historical periods that parallel important developments in the history of the novel; Jane Austen exhibits the "reasonable" approach to the process of learning through experience; the romantic Sheridan Le Fanu shows reconciliation through faith; Henry James, whose examination of the romantic will is the most thorough, illustrates the increasing complexity of the problem at the end of the nineteenth century; E. M. Forster, almost Miss Bowen's contemporary, indicates one twentieth-century approach to the problem through irony. Towards a demonstration that such a tradition exists and that Miss Bowen's acceptance and modification of it (morally and aesthetically) is both representative of and relevant to "contemporary life" this thesis is dedicated.

The word "demonstration" has been deliberately chosen, for the method adopted in this study is literally a "showing forth." Elizabeth Bowen's eight novels have been used as primary evidence with the assumption that only by empirical examination, supported by copious quotation, can the vague be made meaningful. Thus the conclusion reached is implicit in the chapters themselves: her novels show the transition from a relatively simple belief that the dilemma of the romantic will can be solved by direct action to the conviction that only by consciously chosen illusion can the romantic will be brought into harmony with external circumstance. The only alternatives to destructive innocence are awareness and acceptance, for, Miss Bowen reiterates, "One must live how one can."

Elizabeth Bowen has accepted one of the novel's traditional subjects and the traditional novel form itself. Using this heritage of the past she has examined anew a universal human problem through the increasingly dark glass of contemporary life. An examination of her literary technique shows that the methods she uses for this reinterpretation are justified by her subject (method and subject, in this case, are both cause and effect). As a result of her art she has achieved relevance--to the past, to the present, to her readers. The conclusions she reaches are those that only art can present: the illimitable romantic will in conflict with unalterable circumstance is a paradox that only metaphor, which is art, can resolve.

531 pages. \$6.75. Mic 56-3437

THE VERSE EPISTLES OF SAMUEL DANIEL:  
A CRITICAL EDITION

(Publication No. 18,796)

Ann Louise Hentz, Ph.D.  
The Ohio State University, 1956

Samuel Daniel's verse epistles fall into three chronological groups. A Letter from Octavia (1599) is a dramatic epistle modeled upon Ovid's Heroides, a type known as the heroical epistle. A Letter from Octavia was followed in 1603 by Daniel's Certaine Epistles, a group of six poems written to distinguished personages of the day. These epistles were influenced by Seneca's Moral Essays; indeed, one of them, "To Henry Wriothesly Erle of Southampton," is translated from Seneca's essay "On Providence." The last group is composed of one poem written to James Montagu, Bishop of Winchester, on his "seacret-wasting Sicknes," a poem evidently written in 1618 and not published during Daniel's lifetime. This epistle, with its topical and autobiographical references, is closer to the tone of Horace's Epistles than are Daniel's Certaine Epistles.

In this edition the text of A Letter from Octavia is based on The Poetical Essays of Sam. Daniel, 1599. The earlier version of the poem which appears in the Arundel MS. is discussed. The text of the Certaine Epistles is based upon the 1603 folio. The manuscript in the Public Record Office is the copy-text for the poem To Iames Montagu. Variants, explanatory notes, and bibliographical descriptions are included.

In the introduction to this edition, a sketch of Renaissance verse epistles is given, as well as a discussion of the writing of verse letters in the grammar schools. Daniel's life and works show his Epistles to be characteristic of his mature style.

The three chronological groups into which Daniel's epistles fall also represent three kinds of verse letters. The Certaine Epistles, with their formality and ethical tone, are the kind for which Daniel is best known, but he started with the heroical epistle, moved through the formal verse essay, and concluded with the more purely Horatian epistle. In this, Daniel follows the general development of the form: the heroical epistle enjoyed an early popularity, but the more occasional Horatian epistle was the kind that finally achieved popularity after Jonson.

Daniel's verse letters lie outside the main stream of English verse epistles, not only in their formal elevated tone, but in the Italian verse forms he adapted to the verse letter. His epistles had little influence on the later writers of verse letters. Yet in Daniel we not only find some of the finest poems of the genre, but in his use of the various kinds we see mirrored the development of the form.

343 pages. \$4.40. Mic 56-3438

## SEAN O'CASEY'S EXPERIMENTS IN DRAMATIC FORM

(Publication No. 18,581)

Robert Goode Hogan, Ph.D.  
University of Missouri, 1956

Supervisor: Donald B. Clark

Sean O'Casey has repeatedly insisted that a dramatist must continually experiment in new forms. This dissertation traces the formal evolution in O'Casey's plays, and attempts to demonstrate that form is an even more integral element in his writing than his celebrated diction or his famous merging of the tragic and the comic.

The dramatist's first major plays, culminating in the masterpiece The Plough and the Stars, were experiments in the technique of combining several actions, rather than the one action of a conventional play, in order to form a choral fusion which evoked catharsis. Such a structure is akin to that of Chekhov in The Cherry Orchard and The Three Sisters, perhaps to that of Congreve, and certainly to that of Jonson in such plays as The Alchemist.

O'Casey's developments and extensions of Expressionism are traced from the controversial second act of The Silver Tassie to its extreme limits of abstraction and proselytization in The Star Turns Red to its more integral use in such plays as Cock-a-Doodle Dandy.

Also in The Silver Tassie O'Casey is found utilizing various techniques in one play--the methods of farce, heightened realism, symbolism, and Expressionism. This strange conjunction is pursued in Red Roses for Me, in which also O'Casey, in a manner unlike Ibsen, experiments with a grotesquely truncated structure of a single action play, and, in addition, in Act III attempts to weld the lyric to the dramatic.

In Purple Dust the dramatist extends the bounds of farce by joining it to satire, and attempts within the bounds of a single action play to achieve the broadness of The Plough and the Stars by a method of illustrative incident. In Oak Leaves and Lavender and in Cock-a-Doodle Dandy, the method of illustrative incident is extended, the utilization of various methods becomes more integral, and fantasy, an important tool of his later years, is introduced. In Cock-a-Doodle Dandy and in The Bishop's Bonfire, the plays of the later years that are most comparable to the early masterpieces, Juno and the Paycock and The Plough and the Stars, the dramatic experiments of "the barren years" are fused into effective and harmonious wholes.

In the Appendix is contained a detailed account of The Silver Tassie controversy, which resulted in the artist's rupture with the Abbey Theatre, which was of greatest significance in turning O'Casey into an experimental dramatist, and which will, doubtless, make him, like Strindberg and O'Neill, one of the most influential forces of the theatre in this century. 277 pages. \$3.60. Mic 56-3439

## A STUDY OF HENRY FIELDING'S PLAYS

(Publication No. 17,321)

Irving William Kreutz, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Ricardo Quintana

Of the total of twenty-eight plays which Henry Fielding wrote, twenty-five of them were performed during his lifetime. One of them was never printed, however. These twenty-four plays make up the subject of this study. All except two of them were written and produced during the years 1728 to 1737, five years before the publication of his first novel. Each play is considered here, first, in its place in the English dramatic tradition, second, in its place in Fielding's canon, and, third, in its relation to the dramatic type of which it is a member. Finally, the study attempts to look at the plays as artistic entities and as exercises in dramatic technique.

At the time Fielding began his dramatic activity, which was to be entirely in the field of comedy, there was in the theatre then for the novice playwright a bewildering array of "types" of comedy from which to choose his models. In the course of his short-lived but busy career Fielding tried almost all of them in various combinations and with varying degrees of success: comedy in the Restoration manner, "comedy of humours," literary and dramatic burlesque, farce, ballad opera, ballad farce, rehearsal play, and pantomime. Love in Several Masques, The Temple Beau, The Modern Husband, The Universal Gallant, and The Wedding Day are comedies in the Restoration mode. They were neither popular nor critical successes, yet they deserve careful scrutiny because, of all of Fielding's plays, they were those on which he lavished the most time and attention. In his third play, The Author's Farce, he turned to pantomime and farce and established the formula that was to serve him so well for the next eight years: the use of the rehearsal play to provide a framework within which he might attack anything which he felt needed satiric attention. The Author's Farce attacks the fad of pantomime and farce; Pasquin is social and political satire of an unprecedented sharpness, as well as a devastating allegory on the state of the theatre itself; Tumble-Down Dick represents more fun at pantomime's expense, using pantomime's own theatrical devices to impale this extravagant and vastly popular nonsense; Eurydice is in only one act far more successful in mocking the mores of the town than were Fielding's formal manners-comedies; The Historical Register for the Year 1736, "avowedly irregular," stretches the "rehearsal play" form almost past its limits to pillory the theatrical, political, and social world. Eurydice Hiss'd, a kind of tour de force in comic technique, is a play-within-a play account of the failure of Eurydice. These are Fielding's most rewarding plays.

In 1731 the popularity of ballad opera in general and The Beggar's Opera in particular led him to turn his attention to this form with The Grub-Street Opera, The Lottery, The Intriguing Chambermaid, Don Quixote in England, An Old Man Taught Wisdom, and Miss Lucy in Town. All are satirical in intent. Rape upon Rape is a full length comedy vaguely in the Jonsonian manner, and The Letter Writers and The Old Debauchees are "straight" farces, the first bland and thin, the second peculiarly vicious. His two adaptations of Molière, The Mock Doctor and The

Miser, are considered by many to be the finest Molière translations in English. Tom Thumb, the most famous of his plays, is a burlesque of heroic drama; The Covent-Garden Tragedy purports to be a burlesque of eighteenth-century classical tragedy. 338 pages. \$4.35. Mic 56-3440

**THE GROWTH OF GUILLÉN DE CASTRO'S DRAMATIC TECHNIQUE AS SHOWN BY EIGHT SELECTED PLAYS**

(Publication No. 18,500)

Richard Neal Krogh, Ph.D.  
University of Washington, 1956

Guillén de Castro's dramatic works were written to earn him money rather than to show his literary artistry. He wished to entertain the theater-going audiences of Spain's Golden Age. His works, in general, follow the pattern advocated by his master, Lope de Vega; therefore, the plays of both writers have many points of similarity. Castro was not so successful or so famous, but he was a competent craftsman notable for good characterization and beautiful versification. Very few autobiographical details appear in the dramas of this Valencian, but we do know that he was restless, irascible, impulsive and not very constant in love. With the help of a wealthy patron he succeeded in earning a living from his dramatic output.

Based on a study of the twenty-seven plays which Bruerton considers to be by Guillén de Castro, this work has used eight plays to show the steps in the growth and development of Castro's dramatic technique. "El amor constante," the first known play of his earliest period, has a revolutionary theme, regicide, and gives indications that character portrayal receives more emphasis in Castro's works than plot development and "enredos." "El Conde Alarcos" is his earliest drama composed from a ballad and marks the orientation the ballad received in subsequent dramas. "Los mal casados de Valencia" is of interest because it is Castro's only play written in only one meter, the "redondilla," and is his only totally satirical work with some supposedly autobiographical references. Don Guillén's use of Cervantes as a dramatic source is found in "El curioso impertinente," just as "Progne y Filomena" represents Castro's borrowing from Greek mythology. We have considered "Las mocedades del Cid" (Comedia segunda) as his masterpiece because of its originality of dramatic concept, its powerful characterizations, its dynamic interpretation of its many ballad sources, its natural dialogue and its beautiful versification. It is the best evidence that Castro was capable of exploring dramatic possibilities on his own, although the play still falls within the framework of the Lopean school. "La tragedia por los celos" illustrates two themes common throughout Castro's theater: illicit love and jealousy. Finally, "El pretendedor con pobreza," probably his last play, was selected to give chronological spread.

Guillén de Castro was for the most part a follower, not an inventor, whose fame did not survive him. The high esteem with which his contemporaries regarded him has given way to the opinion that he should be remembered mainly for his influence on Corneille, whose drama "Le Cid" was directly inspired by Castro's work. We have attempted to point out that it is on his ballad plays,

especially "Las mocedades del Cid" (Comedia segunda), that his fame must rest, for in them are found his best characterizations and situations skilfully directed to a satisfactory climax. 143 pages. \$1.90. Mic 56-3441

**THE SEVENTEENTH-CENTURY CRITICS  
AND BIOGRAPHERS OF MILTON**

(Publication No. 17,326)

M. Manuel, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Ricardo B. Quintana

Since the seventeenth century has found favour with many modern critics and Milton has not, this study aims at presenting Milton as seen by his contemporaries and immediate successors. Milton's early poetry was hailed by discerning judges like Wotton, Lawes, and Mosley as the most authentic voice of the English Muse yet. But his polemical writings made very little impression on his contemporaries, though after his death his ideas became the main planks of the Whig revolutionary platform and the target of attack from Tory writers. Milton was a live issue with the Government, the Universities, and in the political life of the country all through the century.

Milton's great works done at the close of his life in virtual isolation from the social and literary life of the age were in their diction and versification revolutionary. But he could not do much to justify the ways of the poet to his public or create the taste for a new poetry. The severe demands made by his innovations in technique and style militated against a wide and immediate popularity. Critics like Butler recognized his great poetic power, but condemned him as a "Schismatick in Poetry, though non-conformable in point of Rhyme."

Dryden was the first great critic of Milton; but he was not as is commonly believed his first great popularizer. Like T. S. Eliot, Dryden thought that Milton was a great poet but not a good one and in his diction and versification a dangerous model. He tried to discredit Paradise Lost with the weight of the prevailing literary theories and accepted models. His play, The State of Innocence and Fall of Man, an adaptation of Paradise Lost, was not an effort at popularizing Milton by presenting him in rhymed verse. It was a play intended for the stage, but for some reason not accepted. It is not a heroic tragedy, but a dramatic opera, a genre becoming popular at the time. In its present form the play is only a fragment of his original design, the operatic parts of the play being unfinished. Many vital links in the story of the fall are missing, showing the incompleteness of the play. Dryden's manner of adapting Milton's material reflects his attitude to Milton's choice and treatment of form and fable.

John Dennis was the greatest of Milton enthusiasts in the seventeenth century and he was deeply influenced in his creative and critical works by Milton's precepts and practice. He found authority in Milton for respecting the Aristotelian rules and at the same time for defining poetry in emotional and psychological terms. He made a very able coordination of the Longinian concept of the sublime with the empirical philosophy of Hobbes and formulated a

theory of poetry for which Milton supplied the definition and illustration, Hobbes the foundation of ideas, and Longinus the aesthetic terminology. Dennis advocated the union of religion and poetry for the glory of both, pointing at Milton's poetry to show what could come of such a union. To Dennis critics like Addison owed a good deal in their view of the aesthetic process and criticism of Milton.

Though modern criticism is sworn to keep the poet's life out of his poetry, many of the anti-Miltonists of today have declared their strong personal dislike of Milton the man, and it is quite clear that they have not been able to overcome this aversion for the person while criticising the poetry. A close study of the seventeenth-century biographies of Milton helps to clear away many of the traditional misconceptions about his personality and create an atmosphere more favourable to an objective evaluation of his art.

302 pages. \$3.90. Mic 56-3442

#### THE PREDICAMENTS AND PERPLEXITIES OF JAMES THURBER

(Publication No. 17,476)

Robert Eustis Morsberger, Ph.D.  
State University of Iowa, 1956

Chairman: Professor B. V. Crawford

Though very popular, James Thurber has received little serious critical attention; too often he is considered merely a humorist and underrated accordingly. Actually he is a serious critic with perceptive insight and superior literary ability and deserves a high rank among contemporary American authors. Thurber is exceptionally versatile, accomplished as a cartoonist, dramatist, and skilled writer of essays, short stories, and fantasies. The view of life he presents is too complex to be summed up in a single thesis; therefore a comprehensive study of his work must show its complexity and scope.

Reacting against the gospel of progress and confidence in man's ability through reason to solve the problems of life, Thurber frequently portrays man as an irrational victim to anxiety, humiliation, and frustration. A perceptive critic of contemporary life, he satirizes its bureaucracy, mechanization, and increasing complexities, which create ceaseless dilemmas and confusion. Thurber is acutely aware of the evil in man's nature, and his repeated attacks on man's inordinate pride and faith in his essential goodness as a rational being resemble the Christian view of original sin. He finds that the most frightening study of mankind is man, whose faith in his rational powers is particularly responsible for the deviltry he enacts. Thurber also dislikes excessive rationalism because it stifles the imagination. He is a romantic in his use of the imagination as a power which can give a heightened insight into life and help man find relief from the too pressing cares of reality.

Though he sees evil as an active force in life, Thurber still believes that decency, love, and beauty exist and are worth fighting for. He recognizes that men can be admirable and wonderful, and in The Thurber Album he portrays people whose values he admires; people who lived with kindness and courage, indulging in neither

self-glorification nor impotent despair. Thurber therefore is not a pessimistic utilitarian but has a balanced outlook. His particular skill in his ability to project his bifocal view of life, to portray those aspects of experience which are precariously balanced between the tragic and the absurd. He uses laughter as a civilizing force, necessary to man's sanity and endurance; and by dramatizing man's dilemmas with humorous objectivity, he effects a comic catharsis.

Thurber is a trenchant satirist, condemning affectation, pretentiousness, and hypocrisy in society, literature, and politics. He is greatly concerned with the relation between men and women, a theme which he exploits through many variations, to give a richly complex picture. Believing in the necessity of unselfish love, he portrays the conflicts in marriage that arise from quarreling, lack of sympathy, and inconsiderate behavior. A recurrent conflict in Thurber's work is the clash between what Dr. Sheldon describes as the cerebrotonic and somatotonic temperaments --the sensitive and introverted versus the arrogant and aggressive personality. Thurber criticizes somatotonia's lust for power and contempt for the rights and feelings of others. He condemns war and the traditional concept of aggressive heroism and praises people who accomplish unspectacular tasks with calm fortitude. Frequently the wives in Thurber's studies of marriage are somatotonic and dominate their less confident spouses. Lately, however, with men engaging in increasingly devastating wars, Thurber has come to see women as a civilizing force restraining men from self-destruction.

Though his manner is humorous, Thurber offers serious criticism of life in an imaginative and original way and with a literary style of genuine distinction. He diagnoses his age and in part transcends it. Part of his satire will become obsolete, but his best work penetrates beneath the surface and should remain a valuable contribution to American literature. 358 pages. \$4.60. Mic 56-3443

#### THEOSOPHY AND THE POETRY OF GEORGE RUSSELL (AE), WILLIAM BUTLER YEATS, AND JAMES STEPHENS

(Publication No. 18,508)

James Howard O'Brien, Ph.D.  
University of Washington, 1956

A large part of the religious and philosophical thought of George Russell (AE), William Butler Yeats, and James Stephens stems directly or indirectly from the teachings of the Theosophical Society, an organization active in Dublin in the late 1880's and the 1890's. The impact of Theosophy on the Irish literary movement has been obscured by stories of fraud and dissension within the Society and by comic accounts, difficult to take seriously, of Irish mystery rites and visions of gods and fairies. This study investigates the activities of the Dublin Lodge of the Society, the formal teachings of Theosophy, and the use each writer made of the Theosophical world-view.

Three conclusions significant for the history of the modern Irish literary movement emerge from a comparison of Theosophy and the work of AE, Yeats, and Stephens: Theosophy furnished a background for the thought of James

Stephens as well as of AE and Yeats; Theosophy introduced the poets to eastern and western religions advocating the development of spirituality or consciousness; and Theosophy provided the poets with a background in comparative mythology which enabled them to interpret the Celtic legends and the poetry of William Blake.

AE, who considered himself first a follower of the mystical path and afterwards a poet, painter, rural reformer, and editor, adapted the Theosophical cosmogony, psychology, and ethics to express both his personal and national aspirations. His vision of life emphasized man's present exile, his need for increasing spirituality or consciousness, his temporary return to his Ancestral Self in vision, and his ultimate return to the Absolute after a series of incarnations. He expressed this vision in a vague "opal-hush" style and in terms which are obscure to the uninitiated. AE outlined his understanding of the inner life in *The Candle of Vision* (1916), in which he utilized much of the Theosophical tradition without mentioning Theosophy.

Theosophy admitted Yeats to the religious and intellectual mysteries of eastern and western occultism. From his acquaintance with the tradition embraced by Theosophy, Yeats acquired the means for interpreting Blake and other predecessors in the religion of art. The Theosophical program introduced Yeats to four teachings, which, though developed and altered in later years, remained significant in his personal and artistic growth: (1) a natural mysticism based on a divided mind; (2) a comprehensive metaphysic describing the One and the Many, and the nature of spirit, matter, and flux; (3) symbolism as the ancient language of the soul; (4) the unity of the sacred books of east and west and of all mythologies and folklores.

Through the influence of AE, James Stephens assimilated many of the Theosophical teachings on God, man, and nature. Since Stephens began writing after the break-up of the Theosophical Society, he was able to select freely from the Theosophical synthesis. Stephens' refinement of Theosophical thought forms an unobtrusive backdrop to his early poetry, his Irish prose fantasies, and his retellings of the Irish legends. Theosophical mysticism, however, appears prominently in his late poetry, in which Stephens endeavored to create a "pure poetry" of the spirit to complement his early songs about man and nature. In this later poetry, however, Stephens often stripped the verse of the requisite imagery.

The combined study of the Irish literary and Theosophical movements is helpful in defining a family of writers with a common religious and philosophical background and in explaining their special handling of Irish myth and folklore. 372 pages. \$4.75. Mic 56-3444

#### THE DEVELOPMENT OF THE POETRY OF EDITH SITWELL

(Publication No. 17,334)

Margaret Bond Odegard, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Paul Fulcher

The purpose of this dissertation is to study the development of Edith Sitwell's poetry: to define her

imaginative world by studying chronologically her use of themes, ideas, language, and imagery.

The dissertation begins with an analysis of the poetic milieu when she started writing poetry in 1915, considering particularly the Georgians and her rebellion against them. Before she began writing poetry she found herself in a meaningless world crushing the possibilities of life. Her rebellion against the Georgians came partly from a distrust of emotion which she felt to be hypocritical because she had known neither joy nor tenderness, partly from a distaste for their poetry lacking texture, visual sense, and rhythmical vitality.

Her early poetry is a facade of terrible gaiety erected in spite of a meaningless universe governed by change, destroying innocence and perception of the meaning of sensuous experience, and leaving the world peopled by characters of unawakened consciousness, puppets of time and change. The techniques of her early poetry include experiments with abstract patterns of sound and synesthetic imagery to express an instructed sensuousness or to criticize the subject of the poem. She adapted techniques from the Symbolists--artifice, synesthesia, and terrible gaiety (from Baudelaire, Rimbaud, and Laforgue). The original sensuousness of her imagery, the control of sound, the exuberant wit, and the nostalgia for childhood give this poetry meanings richer than it seems to have at first glance.

Beginning in 1926 she begins to search for meaning which will redeem change from its horror. At the end of the decade she expresses a sense of betrayal, of terror close to the edge of sanity at the barbarism of twentieth century society.

Before analyzing her later poetry, the dissertation discusses her theory of poetry as the latter emphasizes in turn the role of sensation, the importance of form, texture, and, later, inspiration and the kinship of poetry and religion.

In her later poetry she combines primitive nature myths, Christianity, the science of Harvey and Oken to celebrate her faith in the potentiality of life in the midst of society given over to war and poverty. Change no longer leads to the death of the heart; the love of Christ gives to change the potentiality of rebirth. In the early poetry the individual was at odds with the universe; appearance was distorted to yield meaning. In the later poetry the mind and the natural world are attuned to each other, and appearances, the sun and the wheat-ear, are holy. In the early poetry she repeated synesthetic images so they became part of a private myth. Later she uses extrinsic symbols to express her synthesis of myths--the rose, jewels, gold, dust, heat and cold, sun and moon, heart and bone, lion and serpent.

The later poetry, in failing to explore a consciousness at war with itself, is outside the main tradition of modern poetry. Though it expresses despair, religious conviction, or a loss of youthful folly, each poem presents one emotion by evocative symbols rather than by conflict with other emotions and their reconciliation. Irony, ambiguity, and wit are absent.

Her poetry first expressed despair at a meaningless world with brilliant technique, then a hesitant search for meaning in change and time, and finally a version of natural supernaturalism--of hope that men will respond to a religion that can give them rebirth as the sun brings rebirth to the fields, and that can lead them out of the moral

ice age of the poor and rich. Now the function of the poet is to recognize and celebrate a sacred universe. Genius is worship.

333 pages. \$4.30. Mic 56-3445

**THE AUDEN GROUP: THE 1930's POETRY OF W. H. AUDEN, C. DAY LEWIS, AND STEPHEN SPENDER**

(Publication No. 17,339)

Justin Maynard Reagle, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Paul L. Wiley

During the 1930's, W. H. Auden, C. Day Lewis, and Stephen Spender shared a concern for many problems that stemmed from what they felt to be the unsatisfactory society in which they wrote. This dissertation analyzes their poetry in order to explore the nature of the thought about these problems and to show the techniques utilized in presenting their convictions. Although poetry and poetic drama constitute the data analyzed, the authors' prose writings are considered whenever they illuminate the poetry; and the study makes use of commentary by critics and friends of the poets. The opinions held by the group are also examined in the light of social theorists who may have influenced their thinking, most notably the Marxists and D. H. Lawrence.

The study deals almost exclusively with poetry produced in the 1930's, for each author follows a similar pattern of development that results finally in the disintegration of the group. In their very early poetry each placed primary emphasis on the individual, Auden on a psychological "change of heart" cure for society; Spender on his and others' inadequacies in an unsatisfactory culture; and Day Lewis on constructing a statement of his personal relationship to the world. But by 1934 the three had moved toward social theory congenial to Marxism and had defined two alternative methods of social action between which they thought the socially conscious man had to choose: elimination of social ills by restoring the individual to full emotional health, or direct change of environment. During the middle years of the decade, the writers favored the latter course of action. But with Spender's repudiation of political action on his return from Spain in 1937, and his subsequent development of a theory of individualism, the writers began to drift apart. Auden soon moved toward a religious emphasis on the individual; and Day Lewis concentrated more and more on individual experience that could be understood, cherished, and dealt with in a world too complex to be encompassed within a political scheme. By the end of the decade, having abandoned their common faith in social action, the writers no longer constituted a group.

Study of the poetic technique reveals that although there were great differences between the poets during the 1930's, each strongly emphasized the social responsibilities of the artist. Each felt a need for poetry that would have meaning for a wide audience. Auden responded in part by developing "popular" forms: burlesque, buffoonery, comic satire, and a number of other verse techniques not capable of brief classification. He finally evolved a witty, colloquial language, packed with intellectual content, that was

not unlike the common social speech of the educated man. Day Lewis, temperamentally disinclined to write slapstick and "prosy" verse, experimented with myth substitutes and organizational devices that would replace lost communal myth and would retain the values of serious poetry even while he preached and warned. Spender met the social demands of poetry not by adopting popular art forms or experimenting with myth but by making certain that the personal experience of which he wrote would be of central importance to an audience living in the modern world.

The persistent concern for society, and for the relationship of art and artist to it, suggests that the Auden group is historically significant as a representative of rather broad social and artistic changes that reached their peak of intensity in the 1930's.

636 pages. \$8.05. Mic 56-3446

**VIRGINIA WOOLF AS CRITIC**

(Publication No. 18,511)

Ralph Emerson Samuelson, Ph.D.  
University of Washington, 1956

The primary demonstration made in this dissertation is that Virginia Woolf's criticism belongs inside the romantic tradition. The demonstration of this central point is made through a study of four areas--Virginia Woolf's interest in the writer's personality, her interest in language, her metaphysic, and her feminism as reflected in her literary criticism.

Virginia Woolf's interest in the problem of the writer's personality is made evident by a citing of her wide reading in letters, diaries, and essays--in short, in all non-fiction of a biographical nature. She is seen to be especially attracted to the essays of Montaigne, whose "incongruous" personality reflected therein appeals profoundly to her sensibility. Montaigne's essays become the unofficial standard against which Virginia Woolf judges the success of other non-fictional biographical material.

From a perusal of several representative essays, it is shown that Virginia Woolf assents to the notion that fiction as well as non-fiction makes one of its primary appeals to the reader through its expression of the writer's personality. The critical notion that great literature is somehow "impersonal" Virginia Woolf implicitly rejects. Her interest in the writing process is revelatory of her further interest in the writer's personality and of her implicit agreement to the concepts of Herbert Read, a critic working explicitly from a romanticist position.

Virginia Woolf's inquiries into language, confining themselves largely to the novel form, develop a distinction between "poetry of language" and "poetry of situation," the latter for her being the more valuable kind of poetry in a novel because more firmly involved with character and plot. Virginia Woolf is shown to be reluctant to investigate language *per se*, confining herself to statements on the importance of the unconscious mind as it becomes involved in the writing process. In connection with this, she emphasizes the differences between British and American English, insisting that a writer's language is less effective when he works in a medium outside his native tongue. Henry James's use of "British" English is thus seen to

involve language problems similar to those faced by Conrad. Ring Lardner's achievements Virginia Woolf celebrates because Lardner epitomizes the American writer creating a literature and language distinct from the British.

The metaphysic guiding much of Virginia Woolf's criticism involves a dualism of reality into both "solid" and "shifting" substance. To reflect reality, literature must attempt to include both terms of his dualism. Put in another way, the problem is to evoke what she calls "the soul," the individual character in all his complexities, without sacrificing the novel's traditional realism. Proust for her is the modern writer most successfully effecting a complete vision of reality in his works.

Virginia Woolf's feminism is seen to be a force informing virtually all of her criticism. The distinct concepts that appear from it are Virginia Woolf's statements on the need for a partial revolt by the woman writer if she is to write well; a development of the notion of a "room"; and the concept of androgyny, shown to be another term for Virginia Woolf's insistence upon the writer's possessing a complete vision.

Virginia Woolf's celebration especially of the unconscious mind in which lies the source of inspiration, of literature as an expression of personality, and her emphasis upon the problems of the woman writer, are all seen in the light of the English romantic critical tradition beginning with Coleridge. It is this tradition which Virginia Woolf is shown to be working from, even as she is involved in modifying the tradition to meet contemporary critical problems. 244 pages. \$3.15. Mic 56-3447

#### **WILLA CATHER: ARTISTIC THEORY AND PRACTICE (VOLUMES I AND II)**

(Publication No. 17,593)

Jean LaVon Throckmorton, Ph.D.  
University of Kansas, 1954

Unlike many writers, Willa Cather has given us much direct statement as to her theory of literary art. The following analysis of her work is based on this statement as found in essays, reviews, and interviews.

Like many modern authors, Willa Cather believes in art as the supreme value of life. "Art" to her is a broad term denoting special sensitivity in almost any aspect of life, and she makes almost no distinction among its various manifestations, referring to music, literature, and painting almost interchangably in her discussions. Whatever its manifestation, art sets the artist entirely apart from a Philistine world which almost inevitably misunderstands and persecutes. Further, this special sensitivity is a sort of divine gift, justifying the artist in almost any type of anti-social behavior.

The work of art itself is not the result of mere technical skill; it is the expression of the artist's whole individuality. In choice of subject and in manner of expression, the artist must work with that which is most personal to himself; he must not consciously create, but must allow his work to grow naturally from inspiration originating deep in the subconscious. Technique has to be deliberately acquired, but must be mastered so thoroughly that it can be used without conscious effort.

Art has its own laws and its own function; it must never be used for intellectual, moral, or social purposes. It exists for the sake of the emotional experience it recreates; it is another form of living, a "sheath for life."

In her own art, Willa Cather draws from the personal experiences which mean the most to her--pioneer life on the prairie, the culture of the Southwest and of France. These experiences are woven into her best work: O Pioneers!, My Antonia, A Lost Lady, Death Comes for the Archbishop, and Shadows on the Rock. In them she successfully evokes the kind of nostalgic "quality of experience" which she believes art to be. She is less successful in the art stories and in One of Ours and The Professor's House. These works deal with what she feels to be the artistic and spiritual poverty of our society, yet she fails to give her subject the careful analysis an effective indictment calls for. Emotional evocation may well create a life experience; it is not an adequate method of exploring social problems.

A comparison of Willa Cather's mature work with her earliest stories shows the development of her technique. Her handling of character is consistent with her artistic aims. Individuals are presented as part of a life situation; they are not constructed to fit any specific theory of human nature, nor are they psychoanalyzed. Lack of form, absence of ordinary conflict, climax, and conclusion, the general "pointlessness" of much of her work, are to be explained on the same basis. Again and again the author speaks of her purpose as the creation of a mood, a feeling, an effect--often equated with the moods, feelings, and effects produced by songs or paintings. For Willa Cather, the appeal of any kind of art was to the senses and the emotions, and her methods of writing are entirely consistent with this clearly-stated aim.

314 pages. \$4.05. Mic 56-3448

#### **A CRITICAL STUDY OF SUSAN GLASPELL'S WORKS AND HER CONTRIBUTIONS TO MODERN AMERICAN DRAMA**

(Publication No. 17,348)

Arthur E. Waterman, Ph.D.  
The University of Wisconsin, 1956

Supervisors: Professors Frederick J. Hoffman  
and Jonathan Curvin

Susan Glaspell (1882-1948) was a Midwestern writer of short stories, novels and plays. Her short stories (1900-1922) follow the nineteenth century local color tradition fostered by the popular magazines of the day. Most of these stories are didactic and romantic, picturing the idyllic life in the small town of Freeport, the Davenport of Miss Glaspell's youth. As she matured she learned to overcome the obvious defects of her earliest work, but only a few of her stories, notably "Jury of Her Peers," are of sufficient artistic merit to survive.

Her first three novels (1909-1915) show a growing ability to present plausible characters in a realistic setting. They also reveal a new awareness of contemporary problems, an interest in the social and moral issues of the day. This interest gained impetus from her marriage to

George Cram Cook in 1913 and her move to Greenwich Village, the center of a social and cultural renaissance.

Inspired by the creative activity of the Village and the general dissatisfaction with the Broadway theater, George Cram Cook founded the Provincetown Players in 1916. This group became an important part of the modern dramatic movement. It was unique among little theaters in its dedication to the American playwright. Eugene O'Neill and Susan Glaspell were the leading playwrights for the Provincetown. Since all but the last two of Miss Glaspell's plays were written expressly for this theater, they serve both as an illustration of the Provincetown ideal and a measure of its effectiveness. Like most Provincetown plays, her seven one-acts (1915-1917) are satiric or idealistic in tone. Two of them, Suppressed Desires and Trifles, have enjoyed continued popularity. In her full-length plays, especially The Verge (1921), she experimented freely with form and idea, wedging European expressionism to American realism. With Inheritors (1921), which examined some of the dangers inherent in the postwar, nationalistic society, she emerged as an important dramatist of ideas. Her dramatic achievement was culminated when Alison's House won the Pulitzer Prize for 1930.

George Cram Cook died in Greece in 1924. Miss Glaspell's biography of her husband, The Road to the Temple (1927), reveals the strong influence he had in strengthening her native idealism and her faith in the American heritage. Her seven later novels (1928-1945) reflect his influence. They are regional novels, concerned with the search of idealistic characters for a rich and meaningful life. In each case the characters find in the heritage of the Midwest a tradition they can live by. Only in her last novel, Judd Rankin's Daughter (1945), was Miss Glaspell able to successfully define her idealism and give it convincing contemporary significance.

Miss Glaspell is important, therefore, for several plays and for her part in the influential Provincetown Players. From her early short stories to her late novels, all her work is unmistakably Midwestern in attitude as well as setting, so that she provides the Midwest with a consistent voice in regionalist fiction and drama.

307 pages. \$3.95. Mic 56-3449

#### DEFOE, SWIFT, AND THE PEACE OF UTRECHT

(Publication No. 17,987)

Robert Lewis Weeks, Ph.D.  
Indiana University, 1956

The dissertation is a study of the writings of Daniel Defoe and Jonathan Swift for the adoption of the Peace of Utrecht. An attempt was made to consider all available background material, to determine as nearly as possible the circumstances under which the work of Defoe and Swift was produced, to analyze their individual techniques, and to evaluate the effect of their various publications on the political world of Queen Anne's England.

The emphasis naturally falls on two major works of each writer: for Defoe, the Review and the Mercator; for Swift, the Examiner and The Conduct of the Allies. The minor pamphleteering work of both men is largely a repetition of the views and techniques of the major works and was not as effective.

*The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.*

The study shows various motives attributable to both men. Defoe employed his pen to make a living by writing for principles in which he positively believed. In the Review, he did not always agree with the ministry on specific issues, but generally supported it. Swift, by working for the Tory ministry, tried to gratify his pride and ambition, but came to believe in what the ministry stood for. Defoe seems to have been much more rational, consistent, and independent than Swift. He was evidently chosen by Harley to appeal to the moderate element of especially the Whig party. Swift was picked to appeal to the extremists of the Tory party. The two helped Harley and St. John steer a middle course, until St. John attempted to run to the Tory extremist position.

Inevitably involved in the study, also, is an analysis of the motives of the ministry in attempting to negotiate a separate peace and to destroy the reputation of the Duke of Marlborough, for in that policy lay much of what governed the attitudes of Defoe and Swift. The ministry, the study attempts to show, was actually doing what it thought it must do to accomplish a reasonable peace.

The techniques of the two men were extremely different, although some journalistic devices, such as insistence on their own impartiality, were used by both. Defoe depended more on statistics and rational argument; Swift depended on venom and satire with the emphasis on persuasion.

The effects of Swift's writings were more quickly and brilliantly seen, but the nature of his purpose was different from Defoe's. The specific effects of The Conduct of the Allies could be measured because the issues with which it was concerned had to be carried to Parliament for a vote. Defoe's Review, running for a longer time than Swift's efforts, was looking for cumulative success and was working to bolster rather than to win a particular vote. The Mercator, however, worked for a particular goal, but its effects were lost in the chaos of the final days of Queen Anne.

In dealing with the background to the party conflict, the study attempts to bring together the strands of political, religious, and economic affairs as they affected the negotiations for the Treaty of Utrecht, particularly as they were reflected in the writing of Defoe and Swift.

241 pages. \$3.15. Mic 56-3450

#### SAMUEL WARREN: AN EARLY CONTRIBUTOR TO VICTORIAN LITERATURE

(Publication No. 18,516)

Samuel Augustus Yorks, Ph.D.  
University of Washington, 1956

This thesis examines the literary achievement of Samuel Warren (1807-1877), a now little-known Victorian author, with particular attention to the conflict between his formulated approach and his actual talent. His theory of composition was fashioned under the pressures of the day, but his gift was that of the romantic who tossed formal considerations to the creative breeze. Like others of his age, Warren was not artistically selfconscious and seemed barely aware of his struggle.

Samuel Warren began writing in the Gothic tradition but under the growing pressure of the middle-class

demand for greater gentility and factuality, he fashioned an approach akin to Defoe's in its premise that the public would not abandon the sensational if assured that morality was served. Passages from the Diary of a Late Physician, Warren's first important work, caught the public fancy by its clever exploitation of the factual, sensational, and moral in a series of informational, lurid and edifying episodes purportedly from a doctor's files.

If the surreptitious satisfaction of the public's craving for sensation and the fulfillment of his artistic composite were the sum of Warren's achievement in the Diary, little need would exist to document it. But Warren actually demonstrated in the better tales a principle that is romantic in its violation of formal considerations and universal laws in the interest of the personal vision. Such a vision, Herbert Read argues, strikes through to truth by means of the distorted, grotesque and incongruous, and is one of the characteristics of modern art. Warren exploits this in setting up a merely conventional situation to point a frayed moral only to twist it in a further convolution and reveal the essence of an age. Few more conscious artists of that day were prepared to do as much. The reader learns little of medicine in these sketches but gets stirring glimpses of Victorian life and Victorian mores in the cities of Britain during the great human dislocation of the Industrial Revolution.

In Ten Thousand a Year, Warren's best known work, the author satirized the liberals and democrats that he saw making over Tory Britain in the years of the first Reform Bill. But the novel is more than a simple attack on its creator's many opponents, for he developed a social fantasy in the threat of an obscure linen-draper to the title of a noble family. But Tory Warren was also an evangelical and so, ironically, his aristocrats were given the middle class virtues of prudence, piety, and fortitude and his vulgar usurper the traditional vices of the nobility--drinking, dicing, squandering, and wenching. Warren was given to self-dramatization, too, and endowed his pretender with many of his own aggressions, for like Titmouse he wished to make his uncertain way in British society, even to the House of Commons. The author was psychologically ambivalent: his innate respect for wealth and position made him wish to displace the aristocrat as well as identify with him. And even the many villains took on conviction from the author's self-projections.

After his two most successful works, which he based partly upon his own experience, Warren increasingly abandoned the sensational and factual in favor of the didactic. Except for his essays, his work thinned, and by 1851 he ceased to write fiction. But Warren had earlier demonstrated many of the techniques of the emerging realist school in his use of notebooks, in his realistic observation and satire, and especially in his tales of ironic contrast and revelation. 276 pages. \$3.55. Mic 56-3451

KASUISTIK DES VERBRECHENS  
IN SCHILLERS DRAMEN  
(Publication No. 17,290)  
Louis Ziemand, Ph.D.  
University of Pennsylvania, 1956

Supervisor: Professor Dr. Ernst Jockers

Guilt and casuistry are two main problems in Schiller's dramas. Schiller's interest in the dark aspects of human nature, especially its inclination towards crime, had the effect that every drama of Schiller invariably contains the history of a crime. Already while a student in the ducal academy he professed great interest in psychology of the abnormal, on which his teacher and friend Abel lectured. Abel thereby used his "collection of strange cases taken from human life" and, in doing so, inspired young Schiller to demonstrating his skill in dealing with the strange and abnormal in human nature. Schiller, of course, presents his cases in the form of the great tragedy. In developing the psychological aspects of the history of a crime, Schiller put special emphasis on the fact, that the perpetrator of a crime will always attempt to justify his actions by an entire system of excuses, will deny guilt by means of some strange fallacies, which he himself may believe in or not according to his intelligence. Schiller was convinced that even the hardened criminal's conscience was always awake, because of the presence in everybody's mind of what was then called the "moral sense." The perpetrator of crime therefore had constantly to use fallacies to suppress his sense of guilt.

In accordance with the three stages of development in Schiller's work: Storm and Stress, transition period, classical period, we can trace the three different ways of treatment of the problem of casuistry in Schiller's drama. In the early drama of Schiller the hardened criminal prevails (Franz Moor, Schusterle, Spiegelberg in The Robbers; Gianettino and the Moor in Fiesco, etc.). This type of criminal always acts out of base motives. His intellect serves only his lust for power. He is the lowest type of human being who neither can nor will ever realize that he is wrong, who will neither admit his guilt nor repent. His casuistry perverts his whole system, it poisons his entire way of thinking.

The somewhat milder type is the "noble" criminal. The latter does not necessarily act out of base motives, he has the ability to distinguish right from wrong, but, being under the influence of strong passions, he cannot out of his own inner powers conquer his violent desires. These unfortunates (Karl Moor in the Robbers, Ferdinand in Kabale und Liebe (Intrigue and Love), etc.) succumb to the passions that overshadow their lives. Nevertheless it is indicated by Schiller that they themselves are victims rather than villains, that their casuistry tends to cloud their minds, with the result, that they themselves believe in the fallacious constructions that cause them to commit evil acts. These fallacies make them believe, that they have been chosen by fate or by some strange whim of nature to be the rulers of the earth; that, being endowed with extraordinary powers of the intellect, their passions must naturally be greater than those of ordinary people. This belief was an outgrowth of the Storm and Stress movement which was well beyond its peak at the time, when Schiller wrote his early dramas. Finally, there are those who

against their will are forced to perpetrate acts of violence in the course of their carrying out some noble mission, such as defending their country (The Maid of Orleans, Wilhelm Tell). These are the ideal figures in Schiller's dramas. They are either free of casuistry or, if ever

overtaken by it, find the strength within themselves to conquer it and to purify themselves by admitting their guilt and submitting out of their own free will to any punishment fate has in store for them.

244 pages. \$3.15. Mic 56-3452

## LIBRARY SCIENCE

THE PRODUCTION AND DISTRIBUTION OF BOOKS  
IN WESTERN EUROPE TO THE YEAR 1500

(Publication No. 17,057)

John Henry Harrington, D.L.S.  
Columbia University, 1956

This investigation is a study of the development of book production and distribution in the West from classical times through the fifteenth century to determine whether it is possible to employ the term "publishing" prior to the invention of printing.

There is abundant evidence that in both classical and early Christian times books were produced and distributed in sufficient quantity to satisfy the demands of a wide market. While it is clear that such activity continued after the fall of the Empire, there is no evidence to show that publishing continued as a highly organized industry. Up to the twelfth century there was considerable preparation and distribution of single titles, as well as of many copies of the same book; chiefly in the monasteries.

From the twelfth to the fifteenth century, rising social and intellectual forces demanded greater production, distribution, and organization in the preparation and circulation of books. The pressing need for written materials and the efforts of monastic and religious publishers to satisfy it increased the economic problems inevitably associated with the increase in production and distribution. The growing realization that this activity was a good source of economic gain gave an added impetus to the foundation of an industry which came to break away from the traditional areas of production (monastic scriptoria) and earlier motivation (spiritual inspiration).

The need for a great variety of accurate texts and commentaries was most acute at the university centers, where large numbers of students and masters gathered for the common purpose of study and investigation. The pattern of individual university organization followed the model of either Paris or Bologna. Their differing

methods of administration often proposed radically different solutions to the many problems of organization, but they were in substantial agreement on the structure of book production and distribution. They worked hard to guarantee the production of correct copies and upheld laws which punished those who violated scholarship as well as honesty.

The university organization provided an adequate solution to the problems of scholars and students, but did nothing for the growing market which was not connected with these schools. The production and distribution of books of devotion, of current literature, of all non-student material were of little or no concern to the university publisher or stationer. Such a large and profitable market was served by book producers who worked under conditions of free enterprise. Essentially the same activities incidental to production were carried on in both the free market and the university world--and must be termed publishing in the strict sense of the word.

The growth of the universities, the revived interest in the classics, and the growing popularity of vernacular literature created an increasing demand for books. Alert business men who were active in the industry continually searched for new and more effective ways to supply the new audience for popular and inexpensive books.

By the middle of the fifteenth century a solution appeared, which was based on the use of moveable type. Although the development of the printing press did much to intensify the rapid multiplication of identical copies, it did not create the book-publishing industry. The early printers wished to remain among the traditional craftsmen engaged in bookmaking; they desired a place for their new printed books alongside the older manuscript copies in homes, libraries, and, above all, in the thinking of their contemporaries. The press was a technological advance which took its place in an existing industry, eventually dominated its activity, and caused it to follow new paths of development and expansion.

193 pages. \$2.55. Mic 56-3453

## MATHEMATICS

### ORDERED RINGS

(Publication No. 17,913)

Steven Jerome Bryant, Ph.D.  
University of Missouri, 1956

Supervisor: Joseph Zemmer

#### Introduction

The original intent of this investigation was an analysis of ordered rings. But the best results obtained are not theorems concerning ordered rings, although the motivation for (and perhaps even the understanding of) these results depends to some extent on consideration of ordered rings.

This dissertation consists of three parts. The first part is devoted to ordered rings, the second establishes a theorem on completely primary rings and in the third part some results on topological rings are obtained.

In the first part it is proved that every Archimedean ordered simple ring is a dense subfield of the reals. Then the interval topology on ordered groups and rings is discussed and some structure theorems for the locally compact case are obtained. First it is shown that every locally compact ordered group contains a subgroup isomorphic to the reals. This result is then applied to prove that every locally compact ordered ring with identity and no divisors of zero contains a subring  $R$  isomorphic to the reals. This subring  $R$  is a group direct summand and the other summand may be taken to be closed under multiplication by elements of  $R$ . For any locally compact ordered ring with divisors of zero it is proved that a subring exists isomorphic to the trivial reals, (i.e., the ring consisting of the real numbers with addition unchanged but every product defined to be zero.)

The principal result of Part II is the following theorem: If  $A$  is a completely primary ring of characteristic  $0$ , then  $A$  contains a subfield  $F$  isomorphic to  $A$  modulo the radical of  $A$ , and every element of  $A$  can be written uniquely as an element of  $F$  plus an element of the radical of  $A$ . This theorem is an extension of a result by Snapper which establishes the existence of the subfield  $F$ , but under these hypotheses does not obtain the decomposition of  $A$  indicated in the conclusion of the theorem.

The last part of this dissertation introduces the notion of a semi-topological ring. Two theorems are proved giving sufficient conditions that a semi-topological ring be a topological ring. 31 pages. \$1.50. Mic 56-3454

### SOME THIRD ORDER ROTATABLE DESIGNS

(Publication No. 17,995)

Donald Andrew Gardiner, Ph.D.  
North Carolina State College, 1956

Supervisor: Robert J. Hader

In the study of the joint effect of  $k$  independent variables on a single dependent variable, Taylor Series expansions to terms of order  $d$  have been used as approximations. The coefficients in a Taylor Series expansion can be estimated by the method of least squares and the variances of predicted responses obtained. The levels of the independent variables can be chosen so that the variances of predicted responses remain constant on  $k$ -dimensional spheres about the center of the region studied. Levels so chosen are said to constitute a "rotatable design."

This thesis is concerned with the construction of rotatable designs when  $d = 3$ . A class of these third order rotatable designs for  $k = 2$  was discovered and four third order rotatable designs were constructed for  $k = 3$ . One design for  $k = 4$  was also presented. Of these third order rotatable designs some were constructed so that an experiment can be performed in two stages. The first stage consists of a rotatable design for  $d = 2$  and the second stage consists of additional experimental points to complete a design for  $d = 3$ . 92 pages. \$1.50. Mic 56-3455

### APPROXIMATING THE AREA OF A SURFACE WITH THE AREA OF A NEARBY POLYHEDRAL ONE

(Publication No. 19,091)

Richard Paul Goblirsch, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor R. H. Bing

Define the area of a homeomorphism  $h$  which maps the boundary  $\Sigma$  of a tetrahedron into Euclidean 3-space  $E^3$  by  $A[h] = \inf \lim_{n \rightarrow \infty} A(h_n)$  where the infimum is taken over all sequences  $P = [h_n]$  of piecewise linear homeomorphisms of  $\Sigma$  into  $E^3$  which converge to  $h$ . It is shown under certain restrictions on  $h$ , restrictions satisfied by elementary surfaces, that there is a number  $k$ , independent of  $h$ , such that  $A[h] \leq k \cdot A(h)$  where  $A(h)$  is the Lebesgue area of  $h$ . The principal tool used to obtain this inequality is the result of R. H. Bing which guarantees the existence of a sequence  $P$  converging to  $h$ .

51 pages. \$1.50. Mic 56-3456

ZEROS OF NEIGHBORING INFINITELY DIFFERENTIABLE FUNCTIONS

(Publication No. 17,246)

Thomas Phillip George Liverman, Ph.D.  
University of Pennsylvania, 1956

Supervisor: I. J. Schoenberg

Both real and complex valued functions are considered.

The first two chapters concern the simple zeros in  $(a, b)$  of real-valued infinitely differentiable ( $C^\infty$ ) functions of the real variable  $x$  on the bounded closed interval  $[a, b]$ . They are seen to depend on "coefficients" in a manner generalising the classical dependence of the simple zeros of a polynomial on its coefficients.

A vector space of these functions is  $C_{(2)}^\infty$ , with the norm  $\|f\| = \max_{a \leq x \leq b} |f(x)| + \max_{a \leq x \leq b} |f'(x)|$ . A simple

zero  $\zeta \in (a, b)$  of a function  $f \in C_{(2)}^\infty$  is the value  $\zeta = S(f)$  of a functional  $S$  that is continuous in  $C_{(2)}^\infty$ .

Chapter I establishes the Gâteaux differentiability in  $C_{(2)}^\infty$  and to every order  $n \geq 1$  of the functional  $S$ ; also the fact that, for any  $g$  with sufficiently small  $\|g - f\|$ , the simple zero  $S(g)$  of the function  $g \in C_{(2)}^\infty$  can be expressed as (m any integer  $\geq 0$ ):

$$(1) \quad S(g) = S(f) + \sum_{n=1}^m \frac{\delta^n S(f; g-f)}{n!} + \int_0^1 \frac{(1-t)^m}{m!} \delta^{m+1} S(f+t(g-f); g-f) dt.$$

The functional form of simple zeros of  $C\{M_n\}$  functions is investigated in Chapter II. Given the logarithmically convex sequence of positive quantities  $\{M_n\}$  the Banach space  $C_q\{M_n\}$  of functions consists of the functions verifying (for a fixed  $q > 0$ )

$$(2) \quad \sup_{n \geq 0} \left\{ \frac{\max_{a \leq x \leq b} |f^{(n)}(x)|}{q^n M_n} \right\} = \|f\| < \infty.$$

The F-space  $\bar{C}_q\{M_n\}$  consists of the functions  $f(x)$  which verify

$$\lim_n \sqrt[n]{\frac{\max_x |f^{(n)}(x)|}{M_n}} \leq q;$$

its topology is defined by the pseudo-norms ( $v = 2, 3, \dots$ )

$$\sum_{n=0}^{\infty} \left( \frac{\max_x |f^{(n)}|}{q^n M_n} \right) (1 - \frac{1}{p})^n = p_v(f).$$

On these spaces,  $S$  has all the properties found for it on  $C_{(2)}^\infty$  and is, furthermore, Fréchet differentiable to every order  $n \geq 1$ . The dependence of simple zeros on "coefficients" is expressed by the fact that, when the simple zero  $\zeta = S(f) \in (a, b)$ , there exists an open set  $O$  containing  $f$  such that  $S$  is a  $C\{B_n\}$  functional on  $O$ . This means that for every bounded closed subset  $A \subset O$  the relations

$$(3) \quad |\delta^n S(g; h)| \leq c_A K_A^n [p_v(h)]^n B_n \quad (n \geq 1)$$

hold for all  $g \in A$  and all integers  $v \geq N_A$  (For  $C_q\{M_n\}$ ,  $\|h\|$  appears in place of  $p_v(h)$ ). The constants  $C_A, K_A, N_A$  which depend on the set  $A$  are given in terms of  $p_v(f)$  and the minimum of  $|f'(x)|$  in an interval  $[\zeta - \delta, \zeta + \delta]$ . The  $B_n$  ( $n \geq 1$ ) are defined by

$$(4) \quad B_n = M_n \quad \text{when } \{M_n/n!\} \text{ is log convex,}$$

$$(5) \quad B_n = n! M_n \quad \text{when only } \{M_n\} \text{ is log convex.}$$

This entails that for quasi-analytic classes  $C\{B_n\}$  the formal Taylor series derived from (1) is summable.

In Chapter III the  $C\{B_n\}$  property of  $S$  serves to show that the solution  $y = \varphi(x)$  of the implicit function equation  $f(y, x) = 0$  (where  $f(y, x)$  is a  $C^\infty$  function of class  $C\{M_n\}$  in both variables), where  $f(y_0, x_0) = 0$  and  $\frac{\partial f}{\partial y}(y_0, x_0) \neq 0$ , is a  $C\{B_n\}$  function in a neighborhood  $I$  of  $x_0$  (i.e.

$$|\varphi^{(n)}(x)| \leq K^n B_n, \quad n \geq 1, \quad x \in I;$$

$\{B_n\}$  being given by (4), (5).

The functional approach is dropped in the concluding Chapter which deals with zeros (of order  $p \geq 1$ ) of neighboring functions holomorphic in the domain  $D$  of the  $z$  plane.

It is shown that  $\zeta_0 \in D$  being a  $p$ -fold zero of  $f(z)$  with  $0 < m \leq |f(\zeta_0 + \rho e^{i\theta})| \leq M$  ( $0 \leq \theta \leq 2\pi$ ) then, if  $\|g - f\|_\rho = \max_\theta |f(\zeta_0 + \rho e^{i\theta}) - g(\zeta_0 + \rho e^{i\theta})| \leq \gamma m$  ( $0 < \gamma < 1$ ), the zeros  $\zeta_i$  ( $i = 1, 2, \dots, p-1$ ) of  $g(z)$  for which  $\zeta_i \neq \zeta_0$ , verify

$$(6) \quad \frac{(1-\gamma^p)^{p-1}}{2M} \rho^p \left| \frac{g(1)(\zeta_0)}{\rho^1} \right| \leq \prod_{i=1}^{p-1} |\zeta_i - \zeta_0| \leq \frac{\|g-f\|_\rho}{m} \rho^p.$$

From (6) it is proved that:  $\zeta_0 \in D$  being a  $p$ -fold zero of  $f(z)$  holomorphic in  $D$ , then if the sequence of holomorphic functions  $\{g_n(z)\}$  (with  $g_n(\zeta_0) \neq 0$ ,  $n \geq 1$ ) converges uniformly to  $f(z)$  so that for the monotone decreasing sequence  $\{\alpha_n\}$  of positive terms converging to zero

$$(7) \quad \lim_n |\zeta_0| \alpha_n = A \leq A(\rho) = \lim_n \|g_n - f\|_\rho \alpha_n$$

(where  $\lim_{p \rightarrow 0} A(\rho) = A$ ), it follows that

$$(8) \quad \lim_n |\zeta_{ni} - \zeta_0|^{p\alpha_n} = A \quad (i = 1, 2, \dots, p);$$

$\zeta_{ni}$  being the  $p$  zeros of  $g_n(z)$  which converge to  $\zeta_0$ .

(8) yields as corollaries a new proof of S. Doss's asymptotic relation on the zeros of the partial sums of a holomorphic power series and also the result

$$(9) \quad \lim_n \frac{\log |\zeta_{ni} - \zeta_0|}{\lambda_n} = \frac{c - R \zeta_0}{p} \quad (i = 1, 2, \dots, p).$$

Here the  $\zeta_{ni}$  are the zeros of the partial sum  $\sum_{i=0}^n a_i e^{-\lambda_i s}$  of a Dirichlet series  $f(s)$  (whose abscissa of convergence is  $-\infty < c < \infty$ ) which converge to the  $p$ -fold zero  $\zeta_0$  of  $f(s)$ .

67 pages. \$1.50. Mic 56-3457

## NUMERICAL INTEGRATION OVER PLANAR REGIONS

(Publication No. 19,126)

William Hollis Peirce, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Preston C. Hammer

The accompanying thesis gives two methods for developing numerical integration formulas over the arbitrary annulus. These methods lead to formulas which are exact whenever the integrand function is a polynomial of arbitrarily high degree. Orthogonal polynomials play an important role in both methods, which are related by the fact that the formulas developed by one method include those developed by the other.

Several specific formulas are given, including formulas that are developed on an individual basis independently of the two methods presented here. The numerical results obtained when these formulas were applied to some common poorly-behaved functions are given, and a brief error analysis is included. 93 pages. \$1.50. Mic 56-3458

## ON ONE-SIDED DISTRIBUTION-FREE STATISTICS

(Publication No. 18,509)

Ronald Pyke, Ph.D.  
University of Washington, 1956

Let  $U_1, U_2, \dots, U_n$  be an ordered sample of a random variable having cumulative distribution function  $F$ . Let

$$D_n^+ = \max_{1 \leq i \leq n} (i/n - U_i).$$

Since this statistic is distribution-free, assume without loss of generality that  $F$  is the uniform distribution function on  $(0,1)$ . Define  $i^*$  and  $U^*$  by  $D_n^+ = i^*/n - U_i^*$ ,  $U_i^* = U^*$ . In this thesis, it is proven that for all  $u \in (0,1)$  and  $j = 1, 2, \dots, n$ ,

$$(a) \quad p_j = P[i^* = j] = n^{-n} \sum_{i=n-j}^{n-1} \frac{1}{i+1} \binom{n}{i} i^i (n-i)^{n-i-1};$$

$$(b) \quad P[U^* \leq u, i^* = j] = \sum_{i=j}^n \binom{n}{i} (1-u)^{n-i-1} (i-nu)n^{-i-1} \cdot \sum_{t=[nu]}^i \binom{i}{t} (nu-t-1)^{i-t} (t+1)^{t-1}$$

if  $nu < j$ , and equal to  $p_j$  otherwise, where  $[x]$  is the largest integer less than  $x$ ;

$$(c) \quad P[U^* \leq u] = u.$$

From (a), it follows that  $p_1 < p_2 < \dots < p_n$ . The asymptotic distribution of  $\alpha_n = i^*/n$  is shown to be uniform; that is, for all  $u \in (0,1)$

$$(d) \quad \lim_{n \rightarrow \infty} P[\alpha_n \leq u] = u.$$

To obtain this result some general lemmas are proven which (i) characterize the symmetry of a distribution, (ii) characterize the uniform distribution and (iii) provide

a sharp bound for the maximum deviation between the uniform distribution function on  $(a,b)$  and any distribution function  $G$  satisfying  $G(a) = 0$ ,  $G(b) = 1$ , and  $G(x_2) - G(x_1) \leq G(x_2 + \alpha) - G(x_1 + \alpha)$  for  $\alpha > 0$ ,  $x_1 < x_2$ , whenever all arguments are in  $(a,b)$ . This bound is a sharp one depending only upon the first moment of  $G$  and is given by

$$(e) \quad \sup_{a \leq u \leq b} \{u - G(u)\} \leq \{2 \int_a^b x dG(x) - b - a\} (b - a)^{-1}.$$

It is a consequence of this result that

$$(f) \quad \sup_{0 \leq u \leq 1} \{u - P[\alpha_n \leq u]\} \leq n^{-n-1} n! \sum_{i=0}^{n-1} \frac{n^i}{i!}$$

it having been shown earlier in the thesis that

$$(g) \quad E(\alpha_n) = 2^{-1} \{1 + n^{-n-1} n! \sum_{i=0}^{n-1} \frac{n^i}{i!}\} = O(n^{-1/2}).$$

Let  $X$  be a random variable with distribution function  $H$ .  $D_n^+$  induces a test of the problem

$H_F$ : Hypothesis  $H = F$ ; Alternative  $H = G \geq F$ .

Similarly, the statistic

$$(*) \quad M_n(X_n; c_n) = \max_{1 \leq i \leq n} \{c_{n,i} - F(X_i)\}$$

may be used for testing  $H_F$ , where  $c_n = (c_{n,1}, \dots, c_{n,n})$ ,  $(0 \leq c_{n,1} \leq \dots \leq c_{n,n} \leq 1)$ , satisfies the size condition

$$P_F[M_n(X_n; c_n) > 0] = \alpha$$

for a given  $\alpha \in (0,1)$ . Let  $C_n(\alpha)$  be the family of all vectors  $c_n$  that satisfy this condition. Each  $c_n \in C_n(\alpha)$  determines a statistic (\*) and a test of  $H_F$ , and shall itself be identified with this test. It is proven that every  $c_n \in C_n(\alpha)$  is monotone and of structure-d and hence distribution-free and partially ordered. Moreover, within this family of tests each member is admissible. Several characterizations of the family of all sub-consistent and consistent tests  $c = (c_1, c_2, \dots)$  are given. For  $\delta \in (0,1)$  and  $x \in [0, 1-\delta]$  define  $G_{x,\delta}(x)$  by  $G_{x,\delta}(x) = 0$ ,  $G_{x,\delta}(x) = x + \delta = G_{x,\delta}(1-x)$  and  $G_{x,\delta}(1) = 1$ . Let  $\beta_{c_n}(x)$  denote the power of  $c_n$  against  $G_{x,\delta}$ . It has been proven that

$$\max_{c_n \in C_n(\alpha)} \beta_{c_n}(x) = \beta_{c_n}(r_x)(x)$$

where  $c_n(r_x) = (\underbrace{0, 0, \dots, 0}_{r_x-1}, c_n(r_x), \dots, c_n(r_x))$ ,

$$I_{c_n}(r_x)(r_x, n-r_x+1) = \alpha$$

and  $r_x$  is the smallest integer  $i$  for which  $c_n^{(i)} > x$ . Secondly, it has been shown that

$$\max_{c_n \in C_n(\alpha)} \min_{x \in [0, 1-\delta]} \beta_{c_n}(x) = \min_{x \in [0, 1-\delta]} \beta_{c_n^*}(x) = \min \{v_n(\delta), 1 - (1-\delta)^n\}$$

where  $c_n^*$  is such that  $c_{n,n}^* = 1-\delta$  and  $c_{n,i}^* = \max(x_{n,i}, 0)$  where  $I_{x_{n,i}+\delta}(i+1, n-i) = v_n(\delta)$  for all  $i = 1, 2, \dots, n-1$ .

63 pages. \$1.50. Mic 56-3459

FUNDAMENTAL LINEAR RELATIONSHIPS  
FOR THE SEVEN-RING  
(Publication No. 17,817)

Robert Wayman Rector, Ph.D.  
University of Maryland, 1956

Supervisor: Professor Dick Wick Hall

The present work represents a systematic application of the methods of G. D. Birkhoff and D. C. Lewis (cf. Chromatic Polynomials, Transactions American Mathematical Society, 1946, pp. 355-451) to obtain certain fundamental linear relationships between the constrained chromatic polynomials associated with the seven-ring. A total of 1505 such relationships are tabulated. From this number a set of 126 relations is selected. This set is shown to be linearly independent and to generate all of the listed relationships. This confirms the predicted results stemming from the general theory of the n-ring.

With the aid of the set of linearly independent relations a system of 36 equations in 36 specific constrained polynomials of the 7-ring and the 36 free polynomials of certain associated maps is explicitly written out. The solution of this system of equations would complete the analysis of the seven-ring.

165 pages. \$2.20. Mic 56-3460

SEQUENTIAL AND RANDOMIZED DISTRIBUTION-FREE TOLERANCE LIMITS

(Publication No. 18,512)

Sam Cundiff Saunders, Ph.D.  
University of Washington, 1956

Let  $W$  denote the set of positive integers. The stochastic process  $X_W = (X_1, \dots, X_n, \dots)$  defined on the probability space  $(\Omega_W, \mathcal{R}_W, P_W)$  is assumed to be generated by countably many independent replications of a random variable  $X$  on  $(\Omega, \mathcal{R}, P)$ , with  $P \in \mathfrak{P}$ , where  $\mathfrak{P}$  is the class of all probability measures on the measurable space  $(\Omega, \mathcal{R})$  which assign measure zero to all one point sets.

Let  $(R, \mathfrak{B}, P_X)$  be the induced probability space of  $X$  and  $(R_W, \mathfrak{B}_W, P_{X_W})$  be that of  $X_W$ . Let  $T_n = \{1, \dots, n\}$  for  $n \in W$ . Now let  $y_{T_n} = (y_1(T_n), \dots, y_n(T_n))$  be the ordered observations of  $x_{T_n} = (x_1, \dots, x_n)$ , where lower case letters are observed values of random variables written in upper case letters. Let  $o(A)$  denote the cardinality of a set  $A$ . Let  $\lambda = (\lambda_1, \dots, \lambda_n, \dots)$  be such that

1<sup>o</sup>  $\emptyset \neq \lambda_n \subset T_{n+1}$  and, for some  $\eta \in W$ ,  $o(\bar{\lambda}_n) = \eta$  for all  $n \geq \eta$ , where  $\bar{\lambda}_n = T_{n+1} - \lambda_n$

2<sup>o</sup> the set valued function  $\bar{D}$  defined by

$$\bar{D}(n, x_w) = \bigcup_{j \in \bar{\lambda}_n} [y_{j-1}(T_n), y_j(T_n)]$$

satisfies the requirement that  $\bar{D}(n, \cdot) \subset \bar{D}(n+1, \cdot)$  for each  $n \in W$ .

Let  $a = (a_1, \dots, a_n, \dots)$ , where the  $a_n$  are non-negative integers such that  $a_n = 0$  implies  $a_{n+1} = 0$ . We now define

a.s.- $P_{X_W}$  the set  $B_{n+a_n} \in \mathfrak{B}_W$  by the following expression

$$X_W^{-1} \{B_{n+a_n}\} = \{\bar{D}(n, X_W) = \bar{D}(n+a_n, X_W)\}$$

(where if '...' is any proposition involving  $X_W$  then

$$\{\text{'...}\} = \{\omega_w \in \Omega_W : X_W(\omega_w) \text{ satisfies '...'}\}.$$

$$\text{Let } S_m = \begin{cases} B_{n+a_n} \cap \bigcap_{j=\eta}^{n-1} \bar{B}_{j+a_j} & \text{if } m = n+a_n \text{ for some} \\ \emptyset & n > \eta \text{ otherwise;} \end{cases}$$

then  $S = (S_1, \dots, S_m, \dots)$  is a sequential sampling plan determined by the decision rule  $r = (\lambda, a)$ . If  $a$  is such that  $\lim_{n \rightarrow \infty} n^{-1} a_n = 0$  then  $P_{X_W}(\bigcup_{m \in W} S_m) = 1$ . Let  $\mathfrak{N}$  be the

space of decision rules which have second components satisfying the limit condition mentioned above. Let  $N$  be the random sample size defined by

$$N(\omega_w) = m \text{ iff } X_W(\omega_w) \in S_m.$$

The random set  $D(N, X_W)$  (where  $D(n, x_w) = R - \bar{D}(n, x_w)$ ) defines the function  $D$  is called a tolerance region and is distribution-free in the sense that the random variable  $Q(N, \cdot)$ , called the (random) coverage and defined by

$$Q(n, \omega_w) = P\{X \in D(n, x_w)\} \text{ iff } X_W(\omega_w) = x_w \in S_n,$$

has cumulative distribution function

$$e(\beta, r) = P_W[Q(N, \cdot) \leq \beta]$$

which is independent of  $P \in \mathfrak{P}$  for any  $r \in \mathfrak{N}$ .

Since  $N$ ,  $D(N, X_W)$  and  $Q(N, \cdot)$  are functions of the decision rule  $r$ , we now define the risk function  $\rho$  as follows

$$\rho(P, r) = E \Psi(N, X_W) + E \Phi(P, D(N, X_W))$$

where  $\Psi(n, x_w)$  is the cost of drawing  $x_{T_n}$  and

$$\Phi(P, D(n, x_w))$$

is the loss when  $P \in \mathfrak{P}$  is the probability measure of  $X$  and  $D(n, x_w)$  is the tolerance region chosen; it is clear that the triple  $(\mathfrak{P}, \mathfrak{N}, \rho)$  is a tolerance region sequential game in which nature plays against the statistician.

If  $X \subset \mathfrak{N}$  is such that for  $\alpha, \beta \in (0, 1)$  we can choose  $r \in X$  for which  $e(\beta, r) \leq \alpha$  then  $X$  is a decision procedure. Several different procedures are obtained and studied (two of which have been discussed earlier in the literature by Wilks [1] and Jarina [11]), using general methods which enable one to find  $e(\beta, r)$  and  $\mu(\beta, r) = E(\beta^N)$  for any  $r \in \mathfrak{N}$ . Also it is shown that the function  $e$  can be expressed in terms of  $\mu$  and its derivatives.

If  $r, r' \in \mathfrak{N}$  and cost and loss functions  $\Psi$  and  $\Phi$  are given then we say  $r$  is preferable at  $P$  to  $r'$  iff we have  $\rho(P, r) < \rho(P, r')$  and we say  $r$  is better than  $r'$  iff for all  $P \in \mathfrak{P}$  we have  $\rho(P, r) < \rho(P, r')$ . Some comparisons of procedures are made for specific choices of loss and cost functions.

59 pages. \$1.50. Mic 56-3461

**SAMPLING FOR AGRICULTURAL PRICE STATISTICS**

(Publication No. 18,008)

Henry Tucker, Ph.D.  
North Carolina State College, 1956

Supervisor: Daniel Goodman Horvitz

In sampling for agricultural price statistics, data which are most easily collected are prices on items offered for sale in stores patronized by farmers. Where the regression of sales on quantity purchased is linear through the origin and where the deviations from regression of prices charged by individual firms is proportional to the square of the quantity, then a simple average of the quoted prices is a best unbiased linear estimate of the average price paid by all farmers for a given good during a specified period. Data collected in a survey of prices in North Carolina provided empirical evidence which supported the use of a simple average of prices.

To obtain the information on prices, a two-stage stratified sample, with uniform sampling rates at the second stage, selected in each Crop Reporting District of the state was proposed. Towns, stratified on population and selected with equal probability, would serve as primary units. All stores selling or buying specified commodities would be listed in the sample town and a random sample of establishments selected for personal interview on prices paid by and to farmers. Since the number of stores in the population would have to be estimated as well as the price, a ratio estimate  $R' = P'/N'$  was used, where  $P'$  and  $N'$  are the estimated totals of prices and numbers of stores, respectively. The variance of the ratio estimate was obtained and estimates of the variance components and population parameters were derived from the data provided by the North Carolina Study.

A cost function for obtaining the sample data was derived and numerical values for the cost coefficients estimated from the North Carolina Study. This cost function, in conjunction with the variance function, was used to provide estimates of the optimum allocation of the sample for obtaining the information with a fixed budget under repeated sampling for a group of commodities in quarterly surveys.

The efficiency of stratification was estimated by determining the comparable estimates of the sample allocation for a two-stage sample ignoring town size strata. The relative efficiency of stratified sampling was generally more than 200 per cent for most commodities, using the variance of the mean for a criterion in comparing the two sampling methods.

The correlation between prices of a given item in successive survey months was examined to determine the gains in efficiency which might be made by replacement of part of the sample in a repeating survey. Little gains, if any, could be anticipated for prices similar to those in this study.

Optimum allocation yielded varying numbers of towns for the several commodities being considered. A compromise allocation using a constant number of towns within each stratum, and adjusting within town sampling rates to conform to the same budget limitations, was considered. Relative efficiency of optimum allocation showed gains of 20 to 80 per cent over compromise.

Large between town variances observed in computing estimates of variances were found to be associated in part with correlation between means and variances. The high correlation for the North Carolina data (.96) would suggest additional stratification as a means of effectively reducing the variance of the sample mean.

124 pages. \$1.65. Mic 56-3462

**MUSIC****A SPECTRUM ANALYSIS OF CLARINET TONES**

(Publication No. 19,120)

Jean Roger Miller, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Chester W. Harris

The purpose of this dissertation was to study the harmonic structure of clarinet tones through the use of an audio wave frequency sweep spectrum analyzer. This study allowed two types of comparisons to be made. First, the comparison of different notes played on the same clarinet by the same subject and, second, the comparison of the same note played on the same clarinet by different subjects. An attempt was made to find whether or not there are any identifiable relationships or patterns of partial spectrums in the two types of comparisons.

The subjects used in this experiment were clarinet students taken from the University of Wisconsin Summer Band Clinic of 1954. The analysis was done with an audio wave frequency sweep spectrum analyzer of a basic

super-heterodyne type circuit. Each subject was required to play chromatically from E 2 to E 5. As each tone was produced, it was fed to the analyzer and the resulting partial spectrum recorded by an oscilloscope camera. The partial spectrums indicate the partials present in the tone and the relative amplitude of each partial present. The partial spectrums were then analyzed from the film and recorded in chart form. These charts indicate the partials present on the film and note the position of the two partials with the greatest amplitude.

The relationships or patterns of partial spectrums in the analysis of the tones of subjects were few in number and in no instance true in every case. There was no consistent agreement in the placement of the formant range even though the same clarinet was used. The primaries of the tones investigated were found on partials varying from the first to the ninth partials. In the clarion register, the patterns are more nearly alike than in any other register. However, the primaries and secondaries varied in location within every note tested. There occurred some similarity of patterns but no two were identical in partials present and the amplitude of these partials.

The overall pattern presented by the partial spectrums was from relatively complex spectrums in the chalumeau register to spectrums containing relatively few partials in the altissimo register. With the majority of the subjects, this decrease in number of partials present when going from low to high was a relatively gentle taper. There was a general lack of even-numbered partials (especially lower ones) in the chalumeau register. Often the subjects producing relatively complex spectrums had strongest partials on ones other than the first. The opposite was true of those subjects with relatively simple spectrums throughout their testing.

As a result of the findings of this study, certain conclusions can be drawn. They are as follows:

- 1) The formant theory does not sufficiently explain the distribution and amplitude of the partials of the clarinet spectrum.
- 2) The harmonic theory does not sufficiently explain the distribution and amplitude of the partials of the clarinet spectrum.
- 3) The relationship of the formant theory and the harmonic theory (or other influencing factors), as explanations of the quality of the clarinet tone, is not clear enough to identify the cause of the harmonic structure of the spectrums.
- 4) The use of the same reed, mouthpiece and instrument by different subjects does not result in identical or closely similar spectrum patterns throughout the entire clarinet range.
- 5) The examples of so-called "characteristic" clarinet tone spectrums in some previous research projects are not compatible with the findings of this study. They are "characteristic" only of that subject using a particular clarinet and playing a particular note.

230 pages. \$3.00. Mic 56-3463

#### THE RELATION OF MUSIC SUPERVISORY SERVICES TO CERTAIN PHASES OF MUSICAL ACCOMPLISHMENT IN SELECTED FLORIDA COUNTY SCHOOL SYSTEMS

(Publication No. 17,031)

Homer Miller Savage, Ph.D.  
The Florida State University, 1956

The purpose of this investigation was to conduct a test of the assumption that music supervisory services are effective in raising certain phases of musical accomplishment in the sixth-grades of selected Florida county school systems. The following questions were chosen for investigation:

1. What effect does music supervision have on the level of musical achievement, in the selected sixth-grades of the selected counties, as measured by the Kwalwasser-Ruch Test of Musical Accomplishment?
2. What is the relative effect obtained with two types of music supervision on these accomplishments?
3. How does supervision affect the achievements made by poor, average, and superior students?
4. How does supervision affect the development of exceptional talent in the students as measured by the Kwalwasser Music Talent Test?

In order to obtain significant evidence bearing upon these questions the equal groups method was used. Two supervised counties, having contrasting types of music supervision, were matched with two equivalent unsupervised counties. The equivalence of the groups was based on the opportunities for learning in the counties, with the presence or absence of music supervision isolated as the only significant factor of difference. Eight areas of comparison of learning opportunities were equated as follows:

1. Size of Schools and Classes.
2. Characteristics of Classroom and Music Teachers: Education, Experience, Salary, and Teaching Ability.
3. Education of the Adults in the Counties.
4. Socio-Economic Status of the Adults in the Counties.
5. Children's Aptitude for Music.
6. Number of Minutes of Music Instruction in the Counties per Week.
7. Pupil Characteristics: Age, Sex, Private Study, and the Number of Students in Each County.
8. Availability of Teaching Materials for Music Classes in the Counties.

To measure the achievements made by the separate groups the Kwalwasser-Ruch Test of Musical Accomplishment was given twice, during the 1955-56 school term, at an interval of five months.

To test the effectiveness of music supervisory services on the musical achievements of the 1200 children embraced by the study the following hypothesis was proposed:

1. There should be significant differences between the first testing mean scores of children in the functions tested in supervised and unsupervised schools.
2. There should be a significant difference between the average gains made in five months time in supervised and unsupervised schools.
3. There should be a difference in the frequency distributions of scores made by supervised and unsupervised children.
4. There should be a difference in the coefficients of correlation obtained in comparing talent test scores with accomplishment test scores in supervised and unsupervised counties.
5. These differences should be in favor of the supervised children.

The findings of the study were as follows:

1. Supervised children were significantly higher in the measured musical functions at the first testing.
2. Supervised children made significantly higher gains over the period of five months covered by the testing program.
3. Equitable amounts of progress were made by poor, average, and superior supervised children. Unsupervised children in the lower quarters of the distributions did not show improvement over a five months period.
4. The talented supervised children were more nearly approaching their capacities for musical accomplishment than were talented unsupervised children.

In comparing the two types of supervision included in the study, a positive relation was found between classroom teacher responsibilities in the instruction of music and pupil growth in the functions under investigation.

The conclusion drawn from the study was that music supervisory services are effective in raising certain phases of musical accomplishment in the counties included in the study. 79 pages. \$1.50. Mic 56-3464

**THE LARGER SACRED CHORAL WORKS  
OF WILLIAM BOYCE, (1710-1779): A STUDY  
AND EDITION OF SELECTED COMPOSITIONS  
FOR CHOIR AND ORCHESTRA (VOLUMES I-III)**

(Publication No. 18,563)

John Robert Van Nice, Ph.D.  
State University of Iowa, 1956

Chairman: Professor Herald I. Stark

There are periods in the history of music when certain composers, then living, achieve great stature in their chosen profession. As a result of this, other excellent composers of the same generation often remain almost unknown, owing to the shadow cast by their more illustrious colleagues. In spite of such accidents of history, many lesser-known men have written music imbued with attractive qualities and with more than passing interest. William Boyce, an eighteenth-century English composer, organist, director, and editor, who lived during the time of Handel's great fame, is one of those men.

In assembling some of the known facts concerning his life, it has been found that the work upon which most of his fame has rested was the three-volume set of Cathedral Music, which contains various works of cathedral composers from the sixteenth to the eighteenth centuries, and his Eight Symphonies, which have been published in modern edition and recorded. It was also discovered that, along with other works, he produced the music for a number of stage productions of his day, as well as a long list of commemorative odes for New Year's day and the King's Birthday.

Still further investigation indicated that several of his larger choral and orchestral works still remained in manuscript. The editing for modern performance of these five compositions, the oratorio, David's Lamentation over Saul and Jonathan; the funeral anthem for George II, Souls of the Righteous; and the three King Shall Rejoice anthems (the first two being the Wedding and Coronation Anthems for Queen Charlotte and King George III, and the third, the St. Paul's Anthem), forms the basis of this study.

Microfilms of the manuscripts of the above works were provided by the Bodleian Library, Oxford University. In the editing of these compositions for contemporary performance, adjustments have been made in the arrangement of the score, in the dynamic markings, and in the notation of the appoggiaturas. Also, spelling, punctuation, and capitalization have been regularized.

Where necessary, vocal parts have been transposed into modern clefs, and the treble and countertenor (male alto) parts have been scored, for the most part, for women's voices.

An organ accompaniment has been provided which can be used independently, if an orchestra is not available. The string parts have been employed as the backbone of the organ part, while the wind instruments and tympani have been added to it, where called for, to provide rhythmic variety and tone color.

A study of the general formal features of these five Boyce compositions indicates that he was quite conscious of the proportion that should exist between the chorus and soloists. He appears, also, to have had a fine talent for setting the texts of these larger works so that the musical and verbal inflections almost invariably coincide.

The general musical style of the eighteenth century appears to be well integrated into Boyce's own style, a circumstance which does not necessarily mark him as an inferior composer. In fact, this study has found him to be one of the composers, who, although overshadowed by the great Handel, was capable of composing music which is deserving of publication in modern edition and of more widespread performance on contemporary programs. In this manner it may become more generally recognized that "Boyce is the leading English-born composer of the 18th century."\*

687 pages. \$8.70. Mic 56-3465

\*H. W. Shaw, "William Boyce," in Grove's Dictionary of Music and Musicians, 5th ed., ed. Eric Blom (London: Macmillan and Co., 1954), I, 863.

**THE SYMPHONIES OF ANTON BRUCKNER**

(Publication No. 18,675)

James H. Wilcox, Ph.D.  
The Florida State University, 1956

The general apathy of the American musical public toward the works of the Viennese symphonist, Anton Bruckner (1824-1896), is due in part to the confusing array of fact and fiction surrounding the man and his music. The tendency to pair Bruckner and Mahler and to associate his style with that of Wagner has resulted in misunderstanding. There has been an inclination to dismiss the symphonies because of their inordinate length and apparent formal irregularities. The confusion which has arisen from the numerous revisions and editions has been resolved with the recent publication of the Originalfassungen under the supervision of the German musicologists Haas, Orel, and Novak.

This study is devoted to a detailed analysis of the stylistic aspects of the nine numbered symphonies of Anton Bruckner with pertinent investigation into the various personal and environmental aspects influencing his style. It is felt that such a study, based upon the recently completed Originalfassungen, will contribute to a more objective appraisal of Bruckner's true worth and position in the history of musical thought in the Western World.

An introductory chapter dealing with Bruckner's biography, influences, and the performances and editions of his music is followed by two chapters devoted to a study of the formal content of the symphonies. Chapter four contains an analysis of the external and internal tonal schemes. Chapter five is a discussion of the various textural aspects of the symphonies: harmonic content, non-harmonic procedures, counterpoint, orchestration, phrase structure and thematic technique. Finally, the concluding chapter consists of a comparison of Bruckner's music with that of certain of his immediate predecessors and contemporaries, in addition to a final summation of the basic forces governing his peculiar artistic expression.

345 pages. \$4.45. Mic 56-3466

## PHARMACOLOGY

### THE QUALITATIVE ACTIONS AND POTENCY OF PURIFIED NATURAL AND SYNTHETIC NEUROHYPOPHYSIAL HORMONES AND SOME RELATED COMPOUNDS WITH DETAILED CONSIDERATION OF THEIR STABILITY

(Publication No. 17,038)

Karlis Adamsons, Jr., Ph.D.  
Columbia University, 1956

The qualitative actions and potency of purified natural and synthetic neurohypophysial hormones furnished by du Vigneaud were studied by improved bioassay technics. Both hormones, oxytocin and the arginine and lysine vasopressins possessed antidiuretic, vasopressor, milk-ejection and avian depressor activities. With respect to their biological behavior, the synthetic octapeptides were qualitatively indistinguishable from the highly purified natural hormones. The pharmacological effects of lysine and arginine vasopressins were the same with regard to their relative vasopressor, milk-ejection, and avian depressor potencies. The ratio of pressor potency to antidiuretic potency for lysine vasopressin was 6, when the latter was determined by intravenous injection in the hydrated dog. On the other hand, the ratio was 1, when the antidiuretic activity was measured by the method of Burn.

The structure-activity relationships of the neurohypophysial hormones were studied by comparing the relative and absolute potencies of a series of related oligo- and polypeptides. Marked deviations from the ratios known for the natural hormones were encountered.

In a study of the spontaneous decomposition of synthetic and natural neurohypophysial hormones in aqueous buffer solutions over a pH range of 3.0 to 8.5 at room temperature, maximal stability for crude, highly purified and synthetic arginine vasopressin preparations was found at pH 3.0 and 8.5. The decay proceeded most rapidly at pH 7.5 in phosphate buffer. Synthetic lysine vasopressin was most stable at pH 3.0 and pH 5.0. It was found to be more stable in the neutral pH range than the arginine analog, but less stable at pH 8.5. The highly purified and synthetic preparations underwent decomposition more rapidly than crude extracts. The antidiuretic, vasopressor and milk-ejection potencies of arginine vasopressin showed identical rates of decline. The velocity of the decomposition of synthetic and natural oxytocin was similar. Both preparations possessed a maximal stability at pH 3.0. Variations in the hydrogen ion concentrations from pH 5.0 to 8.5 influenced the rate of decay only to a moderate extent. The stability of endogenously liberated ADH in plasma was identical with that of purified arginine vasopressin in phosphate buffer solution at the same pH. Oxytocin, on the other hand, underwent decomposition considerably faster than the control in a buffer solution. Fifty per cent of the activity was lost in about 40 hours.

Stimulation of the neurohypophysis by intracarotid injection of morphine sulfate or acetylcholine led to a liberation of the antidiuretic hormone in quantities exceeding that of oxytocin several fold. In some instances the

plasma was virtually free of the latter hormone although high concentrations of the antidiuretic hormone were present.

73 pages. \$1.50. Mic 56-3467

### THE EFFECT OF VARIOUS SUBSTANCES ON THE DISINTEGRATION OF TABLETS

(Publication No. 18,845)

Rodolfo S. Escabi-Perez, Ph.D.  
Purdue University, 1956

Major Professor: H. George DeKay

This investigation was undertaken with the purpose of contributing some light to the problem of disintegration. The effect of various substances on the disintegration of tablets was made the central object of the search, with the investigation of the capabilities and evaluation of the relative merits of the substances as tablet disintegrants as the immediate objective.

Two grades of Solka Floc<sup>1</sup> — a highly purified wood cellulose —; three grades of Stadex Dextrin<sup>2</sup> — representing starch at different stages of hydrolysis —, four recently suggested agents under different conditions,<sup>3</sup> one soluble substance, and cornstarch were investigated under different conditions of medicament, binding solution, running powder, granule size, hardness, weight, moisture, incorporation and storage.

Granule size was found to be a fundamental factor in disintegration, and of greater importance than reasonable variations in hardness and/or in weight.

A general pattern of behavior of decrease in disintegration time with smaller granule size, irrespective of medicament, disintegrant, and binder, was evidenced in all the series.

The #30 granule size was found to be a more desirable size for consistent and exacting tabletting than either the #12 or the #60 granule sizes.

The maximum percentage of moisture for successful tabletting was found not to be fixed at the 4% level.

Calginate, methylcellulose 4000, Veegum and Kelacid, in that order, either in 10% or in 5% concentration in the dry mix, were found to be definitely superior in most cases, and in a few cases equally effective disintegrants to cornstarch and Dextrin 10 for tablets of insoluble medicaments granulated with either starch paste or with sucrose solution. The Solka Flocs, Dextrin 25 and Dextrin 60 appear to have some binding properties. Solka Floc BW-100, however, ranked with the best for sulfathiazole tablets.

Added in the running powder with magnesium stearate, Calginate, Veegum, methylcellulose 4000 and Kelacid, in the order mentioned, proved to be definitely better disintegrants than either cornstarch, sodium benzoate, or Carbowax 6000.<sup>4</sup>

Three per cent additional original disintegrant in the running powder was found to accelerate the disintegration

with all the substances investigated; yet the order of activity was not affected.

Three per cent of a soluble substance in the running powder did not significantly alter the disintegration time nor the classification according to relative disintegrating activity.

Aging for 2160 hours at room temperature caused relatively little change; aging at 40°C generally caused a greater variation. The difference is, in many cases, considerable. Methylcellulose either decreased or remained constant, Calginate and Kelacid mostly remained constant.

For tablets of the soluble medicament<sup>5</sup> granulated with starch paste, cornstarch and Solka Floc BW-100 proved to be the very best and equally effective disintegrants, followed by Solka Floc BW-40, methylcellulose and the Dex-trins.

Aging for ten months at room temperature caused changes in 14.3 percent of unlubricated sodium bicarbonate

tablets as compared to 42.8 per cent in the batches lubricated with magnesium stearate.

Prediction of tablet stability on a rapid, practical basis will probably have to be based on simultaneous exposure to both elevated temperature and some other condition, such as controlled humidity.

164 pages. \$2.15. Mic 56-3468

1. Brown Company, Boston 14, Mass.

2. A. E. Staley Mfg. Co., Decatur, Ill.

3. Methylcellulose 4000 cps NF IX; Kelacid—a refined alginic acid of the Kelco Company, N.Y.C. 5—; Calginate—the calcium salt of alginic acid of the same company—; and Veegum HV, of the R. T. Vanderbilt Co., Inc., N.Y.C., N.Y.

4. Carbide and Carbon Co., N.Y.C., N.Y.

5. Calginate, Kelacid and Veegum were not included in these series.

## PHILOSOPHY

### MORAL JUDGMENT AND SELF-KNOWLEDGE

(Publication No. 19,235)

Jordan Maurice Churchill, Ph.D.  
Columbia University, 1956

Chapters I and II develop the pertinence of self-knowledge to the criticism of ethical theory and to moral judgment.

Chapter I. From the interdependence of theory and practice, it follows that ethics may be criticized with respect to its adequacy in fulfilling the requirements laid upon it by practice. One claim upon ethical theory is that it shall state correctly the agent's practical commitments, a claim which can be satisfied only if the agent has self-knowledge adequate for him to know that his theory does this for him.

Chapter II. The deliberation, prior to judgment and action, on concrete alternatives of action utilizes both knowledge of the self as a given resource of action and self-knowledge as the ever-present ideal reference of action.

Chapters III, IV, and V consider three different conceptions of the self and the relevance of self-knowledge to ethics.

Chapter III considers the view of David Hume that human nature is a system of fixed traits; that there is a determined behavior proper to man; and that the exposition of the foundation of morals in human nature confounds artificial rules of behavior thrust upon a reluctant or unwitting mankind. Hume's theory is inadequate to account for both the facts of human nature and human nature as the foundation of normative ethics.

Chapter IV considers the view of F. H. Bradley that the self is a universal whose realization is the moral life. Bradley's theory does not account for the existence of the empirical self or for the continuity of its moral experience; it relies heavily on uncriticized feeling; and its

metaphysical bias renders it unsuited to illuminate practical difficulties of conduct.

Chapter V considers the attempt by G. H. Mead to explain, behavioristically, how the self comes to be made by society out of an organism and how society is remade by the self; behaviorism is the language of control, and the exposition of the social process makes possible the controlled social reorganization which is the central moral problem. Mead's theory is narrow because it is based on comparatively perfect cases of social cooperation, and it fails to take account of the ideal.

Taking the main problem of self-knowledge to be the relation of the self to its ideals, the conclusion finds the knowledge defined by control in the discrimination of the stimuli to which the self responds, by means of which self-control is possible. The ideal is the comparatively well-discriminated activity. Discrimination can proceed without limit, but has its practical limitations in the satisfactory act and in the early saturation of the overt act by meaning. Hume and Mead point to human activity as a natural response, and Bradley to the ideal in the discriminated response. Complementary to knowledge as power is knowledge as vision, for which self-knowledge is a theoria of man and the self in a cosmos which explicates values only implicit in the knowledge of control.

248 pages. \$3.20. Mic 56-3469

### PRESENCE AND SUBJECTIVITY

(Publication No. 17,752)

Frederick James Crosson, Ph.D.  
University of Notre Dame, 1956

This dissertation is an examination of the effort of phenomenological existentialism to transcend the idealism-empiricism alternative of modern philosophy.

The notion of the subject as sketched by Descartes was developed in opposed directions by later thinkers. For empiricists, the subject was interpreted psychologically, and thus integrated into the world of objective place and causality. For idealists, the notion of transcendental subjectivity effectively removed the subject from the world, but also tended to reduce the world to its presence to the subject, understood as the Absolute Subject by Hegel. Against this latter development, Kierkegaard asserted the irreducible character of the individual human subject.

The problem for Kierkegaard's successors thus presented itself as twofold: first, to manifest the impossibility of explaining the experience of the subject by empirical causes, and second, to show that human subjectivity was essentially finite, incarnate and open --in short, only a partial and not a total presence.

First, then, theories of attention and sensation in empirical psychology upon examination are seen to rest on contradictory, although implicit, assumptions concerning the nature of knowledge. Gestalt psychology had already indicated this, but itself was guilty of similar assumptions concerning the causality of physical forms.

The phenomenological reduction reveals the status of the world of original experience intrinsically related to the subject. Man is a being-in-the-world, and things in the world are originally present to him in a non-objective fashion. Theoretical reflection as it is conceived by empiricism ignores this original form of presence and considers things as independent and unrelated to the subject. This accounts for the non-human character of the world described by science, and the fact-value dichotomy at the heart of empirical thought.

On the other hand, my experience of my body makes it clear that it cannot be understood as an object, as both empiricism and idealism attempted to do. The presence of my body is implicit and is rather the condition of the appearance of objects, than an object itself. It is not in objective space, but is rather my means of access to the space of objects. Similarly, my communion with others is not through the explicit grasping and interpreting of objective signs (gestures, facial contortions, sounds) but is direct and immediate. These "intermediaries" appear only when an objective attitude is adopted.

In ontology, this view of human existence implies the understanding of reality and truth as rooted in encounter and coexistence with the lumen naturale of consciousness. Man reveals the meaning of things through participating in a Presence, and thus the concrete structure of his life is that of a partial presence of which subject and object are only abstract moments. Because the meanings of things which he reveals are successive revelations, human presence is a history. Because his presence is a partial presence, it is limited to a present, but a present including two horizons: a future-as-present and a past-as-present. In a profound sense, then, time constitutes the meaning of life.

It is on the ontological level that the existentialists are most radically opposed. Sartre and Merleau-Ponty reduce the meaning of being to its presence to man, while Heidegger and Marcel both envisage man as the witness to and revealer of truth which is not of his own making. With these latter, existentialism appears to have surmounted the dialectic of idealism and empiricism, and to have opened up the possibility of a fruitful dialogue with traditional thought.

180 pages. \$2.35. Mic 56-3470

## THE ORIGIN OF IDEAS ACCORDING TO THE LATIN AVICENNIAN TRADITION

(Publication No. 18,074)

John Francis Fitzgibbon, Ph.D.  
University of Notre Dame, 1956

Supervisor: Daniel C. O'Grady

In his De Anima Avicenna lists five internal sense powers, two of which have two distinct functions depending on whether or not they are acting in conjunction with the intellect. These internal sense powers not only play an important role in sense knowledge but also offer a positive contribution to intellectual knowledge.

When acting purely on the sense level, the estimative is the noblest power and so is to animals what the intellect is to man. However, in man, the estimative power plays little or no part in his rational knowledge. The two most important sense powers in man are the imaginative power and the memory which, when functioning in connection with the intellect, are known as the cogitative power and the reminiscing power respectively.

Due to the neoplatonic influence of the Liber de Causis and the Theology of Aristotle, Avicenna concluded that the soul is a simple substance, sufficient unto itself, and that it is the form of the body only in respect to its function, not in respect to its essence or substance. Thus the powers of the soul, which can be called mere instruments, are more accurately described as phases of the activity of the soul and are not to be considered accidental forms.

The sole efficient cause of all ideas is the agent intellect. The various stages of potentiality to be found in the possible intellect are nothing more than the various relations which the soul has to the agent intellect. Absolutely speaking, the soul can always be said to be in potency while in the body. This is so because it cannot know all things and so is always able to learn. Nevertheless, there is a progression of knowledge in the soul. Before the soul has known anything intellectually it is in a state of pure potency. Once it has grasped the first principles of all knowledge it is said to be in a habitual state. However, this is not the habitus of the Thomistic theory of knowledge; rather, it is merely an aptitude of the soul for being joined to the agent intellect. There is also a second intellectus in habitu which comprises the third stage of the soul's progress in learning. This, indeed, is a more perfect aptitude than the former but, nevertheless, it remains an aptitude and is not in itself a real perfection of the intellect or soul.

Ideas always originate with the agent intellect and from no other source. Avicenna's doctrine of knowledge is an emanation theory in which the intelligible forms come directly from the agent intellect. Likewise, it can be called a confrontation or presentation theory since to know is nothing more than to have the intelligible forms present to the soul.

How then do the sense faculties enter into intellectual knowledge? So long as the soul is in the body it must, at least in the beginning, turn to the images in the imagination in order to see there the singular forms and to consider and compare them. Then it is made suitable for turning to the agent intellect in order to receive from it the intelligible forms. The forms in the imagination are

co-similar to the forms in the agent intellect and so are merely the occasion for the soul to turn to the agent intellect.

Avicenna's influence on the Middle Ages was great and we cannot hope to have a thorough understanding of the scholastics without knowing something about his philosophy. A great deal of neoplatonism influenced his works but full credit must be given to Avicenna as an independent and penetrating thinker. 168 pages. \$2.20. Mic 56-3471

#### COPERNICUS, GALILEO, AND IDEAL CONDITIONS

(Publication No. 19,243)

Robert Lincoln Harder, Jr., Ph.D.  
Columbia University, 1956

This work studies the concept of ideal conditions as it occurs in the work of Galileo Galilei, and asserts that an important reason for the prevalence of the notion of ideal conditions in Galileo's physics is bound up with the use of mathematics as an organizing discipline in that physics. Since the mission performed by the concept of ideal conditions involves both historical and logical factors pertaining to the relation of mathematics to science, both the historical and the logical contexts are investigated.

Investigation of the historical context lying behind the use of the concept of ideal conditions in Galileo's science involves a study of the relationships of mathematics, astronomy, and physics in the history of science. The pre-Copernican mathematical physics is treated very briefly; but the emphasis on mathematical organization of observations which permeates astronomy throughout much of its history is treated in some detail. Aristotle's physics and astronomy and their interrelations are examined and Ptolemy's astronomy and its relationship to Aristotelean thought and to mathematics are studied, since these form a necessary background to the understanding of the work of Copernicus. The way in which Aristotle's physics is teleological and essentially a non-mathematical treatment of corporeal actualities is exhibited, and the way in which Ptolemy's astronomy constituted a calculating device rather than a cosmology, is shown. The Copernican astronomy and the suggestions it makes toward revisions in the Aristotelean physics are presented, together with an account of just what major revisions and reinterpretations of the Ptolemaic astronomy were made by Copernicus. The major implications for science of the Copernican work are developed, and suggestions are made as to why a post-Copernican physics which takes Copernicus's work seriously should be a mathematical physics, involving the notion of ideal conditions as an important operating concept.

The logical context of the notion of ideal conditions is studied, and it is shown how the introduction of mathematics into physics requires the notion of ideal conditions as a bridge between theory and experience. The kinds of conditions specified as ideal by investigators are divided into two major categories, technical conditions and theoretic conditions. The relationship of both of these categories of ideal conditions to experiment is discussed, and the responsibilities of the investigator toward his specification of conditions as "ideal" for a given situation, and

his defense of those specifications, is analysed. Use of theoretic conditions in construction and in refutation is discussed. The extent to which the change from teleological to non-teleological formulations involves the employment of ideal conditions is pointed out. Various subsidiary problems involving the notion of ideal conditions are also investigated.

Galileo is dealt with as a major example of a post-Copernican scientist who took the Copernican astronomy seriously, and whose work involves mathematics as an organizing discipline and therewith the notion of ideal conditions. Galileo's employment and defense of the concept of ideal conditions is illustrated in detail through citations from his works, and his attitude toward experiment as a tool for persuasion rather than discovery is illustrated.

It is concluded that the notion of ideal conditions constitutes an integral part of the non-teleological mathematical physics developed by Galileo, and that the notion of ideal conditions can be viewed as the operating condition of astronomy, conceptualized and introduced into terrestrial science. 185 pages. \$2.45. Mic 56-3472

#### THE EDUCATIONAL PHILOSOPHY OF HENRY ADAMS: A BRAHMIN CONTRIBUTION TO CRITICAL REALISM

(Publication No. 19,134)

Clarence Kenneth Sandelin, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Henry A. Pochmann

Henry Adams (1838-1918) analyzed basic educational issues which are still in controversy today. The relation of educational practice to social theory he saw as a paradox which, unless resolved, could lead America to tragedy. Could a democracy educate its citizens for effective life without repudiating democratic ideals in the process? He studied the problem in the family, the school, the college, and the university.

His Brahmin heritage taught him education was the real business of life, by which divine will was propagated. It required piety to God, benevolence to humanity, deference to parents, and honesty with self. Stressing the values of truth, duty, and freedom this creed tended to be intellectual and masculine in quality, thus slighting the values of love, compassion, and forgiveness which, tending to be emotional and feminine, found only limited expression in the American family. Important as feminine influence was, and had always been in other cultures, even this small benefit would be lost as women were democratized. The family, basic social unit in education and life, was threatened with disintegration.

General education at all levels remained moribund until the middle of the nineteenth century, held in the grip of religious conservatism which opposed modern science. Adams was convinced a scientific approach was essential to American development. Reforms by men like Mann brought joy, freedom, and utility to the common schools, but in the long run universal education served only to polarize the mass mind, while it sacrificed individuals. Reforms by men like Eliot gave incentive, freedom, and responsibility to college students, but the net effect of the

elective system was to relinquish directive control, so future leaders gained no effective training for their responsibilities. The gain in freedom, in both reform efforts, was balanced by a loss in social force.

Two university ideas were imported from Europe. The first envisioned the university as a major agency in the national government operating as an intellectual directorate, in the manner of the University of France, to encourage learning, to define problems of social importance, and to concentrate talent and resources. The Adams Family, with a faith in strong executive organization, all wanted a national university, and John Quincy Adams approached the conception in his labors to establish the Smithsonian Institution. The second idea, deriving chiefly from Germany, envisioned the university as an independent institution, free as possible of obligations in the routine business of society, where a community of scholars might find common support in disinterested and creative study. Though Henry Adams helped to develop a modified form of German scholarship at Harvard, his own efforts there were consistently related to social problems, and he

grew progressively dissatisfied with the disinterested attitude of so-called pure research. Like the elective system, disinterested study scanted the pressing needs of society.

But as the twentieth century approached, Adams became convinced that all these approaches to education were obsolete. Traditional concepts of God, society, man, and nature no longer seemed to form the premises of popular belief, and were in any case inconsistent with the amoral conclusions of science, so that such values as truth, duty, and freedom no longer had relevance for education. If there had been a doubt that democratic man could develop the moral and intellectual ability to direct his own progress under the relatively simple conditions of nineteenth-century democracy, it seemed absolutely clear that another Newton would be required to discover a new principle of unity in the chaos of force revealed by twentieth-century science. A new species of scholar statesmen was essential to simple survival of men and nations.

580 pages. \$7.35. Mic 56-3473

## PHYSICS

### PHYSICS, GENERAL

#### CHARGE ANALYSIS FOR LARGE ANGLE SINGLE COLLISIONS OF ARGON IONS INCIDENT ON ARGON ATOMS WITH ENERGIES TO 138 KEV.

(Publication No. 18,318)

Robert James Carbone, Ph.D.  
The University of Connecticut, 1956

A charge analysis at each large angle of scattering was made for the collision products resulting from a singly charged argon ion beam incident on argon atoms. The beam was passed through a gas chamber containing the target gas. The pressure of this gas was chosen low enough to insure that single collisions would predominate. Two detectors were used in conjunction with an electrostatic analyser to measure and separate each charge state respectively. One of the two detectors used was a secondary emission tube which made it possible to measure the neutral component present. The other detector used was a Faraday cage which measured the absolute current of each charged state. The collimating holes before the detectors permitted a resolution of  $\pm .75^\circ$ . The angular range for this experiment was 4 to 22°, and the beam energies were in the interval of 11,000 to 138,000 volts. The data can be used for a determination of the functional relationship for the ionization produced. This ionization is considered in detail and was found to be a function of the distance of closest approach in a collision.

56 pages. \$1.50. Mic 56-3474

#### DISPERSION OF A LONGITUDINAL STRAIN PULSE IN AN ELASTIC CYLINDRICAL BAR

(Publication No. 19,361)

George Roy Fox, Ph.D.  
Lehigh University, 1956

A longitudinal elastic strain pulse has been produced in a long cylindrical bar by applying known time and space dependent stresses to one end. Using these stress conditions, a method has been worked out for predicting the strain at large distances from the end of the bar. The predicted dispersive behavior of the pulse has been tested by comparison with experimental strain measurements.

Stress is applied to one end of the bar by reflecting a shock wave from that end. With the reflection of the shock, the pressure on the bar rises very suddenly and then remains constant for a relatively long time. The resulting strain pulse is detected by means of barium titanate gages placed on the surface of the bar at various distances from the stressed end.

In analyzing such a strain pulse, a bar of infinite length is considered, with a body force uniform over the section  $z = 0$ , in the axial ( $z$ ) direction, and having a step function time dependence. The equations of motion are solved by use of Fourier transforms and expressions are obtained for the strain in the form of integrals in which the frequency and wave number are related by the Pochhammer-Chree frequency equation. It is assumed that the strain in the infinite bar is the same as that in the bar of semi-infinite length at large distances from the end, although radial stresses at the end are not equivalent.

The expressions derived for the strain in the infinite bar are evaluated asymptotically for large  $z$ . Comparison with experimental results indicates that after a distance

of travel of roughly 20 diameters the main features of the strain pulse are adequately described.

The predicted shape of the beginning or head of the pulse is in very good agreement with experiment. Part of the head travels along the bar faster than the bar velocity ( $= \sqrt{E/\rho}$ ). Periods and amplitudes of oscillations following the head of the pulse are also correctly predicted.

Second mode oscillations are observed, having the predicted period, amplitude, and arrival time. In addition, oscillations of the expected nature are found in the region of the pulse corresponding to the minimum group velocity for the first mode.

It is suggested that failure to match the radial stress end condition may not be important in determining the strain at large distances from the stressed end of the bar.

112 pages. \$1.50. Mic 56-3475

### MAGNETO-HYDRODYNAMICS OF COMPRESSIBLE FLUIDS

(Publication No. 19,158)

Richard Montgomery Patrick, Ph.D.  
Cornell University, 1956

The equations of motion governing a non-viscous conducting gas in the presence of a magnetic field are given and discussed. The case considered is for an ionized gas where there is no charge separation. The equations of motion are studied for two cases, namely, where the gas conductivity is infinite and where the conductivity is finite. The characteristics for the system of equations are obtained for the case where the conductivity is infinite in the same manner as in Reference 1 and 2. The characteristics for this case turn out to be similar to those for ordinary hydrodynamics except the sound velocity is replaced by the following

$$\sqrt{\frac{\gamma p}{\rho} + \frac{H^2}{4\pi\rho}}$$

where  $\sqrt{\frac{\gamma p}{\rho}}$  = velocity of sound in a perfect gas

$$\sqrt{\frac{H^2}{4\pi\rho}} = \text{Alfvén velocity (Reference 3).}$$

The equations of motion are investigated for a special case where the conductivity,  $\sigma$ , is large but finite. The case treated is for a special geometry where there is axial symmetry and the dependent variables are functions of the radius from the axis of symmetry and time. The characteristics are found for the case where the velocities are in the radial direction, the magnetic field has an azimuthal component only and is a linear function of the radius. This corresponds to a long cylinder of highly conducting gas, where the current density is constant. The characteristics for the complete system of equations were found neglecting terms of the order of  $\sigma^{-2}$ . The results of this calculation showed that for this case there are four characteristic directions in  $r, t$  space as in the case for infinite conductivity which reduce to the same results in the limit of infinite conductivity. There are four distinct roots to the characteristic equation, one of which is equal

to the fluid velocity as in the above case, two of which correspond to the sound velocity plus the Alfvén velocity as above with a term depending upon  $\frac{1}{\sigma r}$  and a fourth which depends upon  $\frac{1}{\sigma r}$ , the sound, and Alfvén velocities in a different manner.

The interaction of a conducting gas and a magnetic field produces currents in the gas which, in turn induce magnetic fields. If  $v$  denotes the relative velocity between the conducting gas and the magnetic field with conductivity equal to  $\sigma$ , and  $\ell$  denotes the length over which the interaction takes place, then the condition for the induced magnetic field to be of the same order as the applied field is for  $R_M = 1$  where  $R_M$  is defined as follows

$$R_M = \sigma v \ell.$$

$R_M$  is a measure of the "magnetic viscosity" or magnetic Reynolds number as defined by Elsasser in Reference 4. An experiment is described where an unsteady magnetic field is furnished by discharging a large capacitance into a transmission line, and the energy in the inductance of the line due to high currents is transferred to a highly ionized gas produced by a strong shock wave in argon as described in Reference 5. The interaction length necessary for an appreciable fraction of the energy in the transmission line to be transferred to the gas is that required to make  $R_M = 1$ . The results of this experiment are given, and accelerations of the highly ionized gas behind strong shock waves in argon of ten percent were measured.

Another physical application of magneto-hydrodynamics is the production of electric power. The magnetic field is produced by a current in a copper coil with conductivity  $\sigma_{cu}$  and the gas motion relative to the field produces a voltage due to  $v \times B$ , which in turn furnishes the current in the coil through electrodes in the gas. The condition for this type of generator to deliver as much power as dissipated in the coil and gas is to have a mixed magnetic Reynolds number,  $R'_M$  equal to unity. This factor is defined as follows

$$R'_M = v \ell \sqrt{\sigma_{cu} \sigma_{gas}}.$$

The application of this type of generator is discussed and a particular example is discussed in detail. This example is a case where ionized air flows around an insulating body with two electrodes, and the coil is inside the body. An efficiency factor,  $\eta$ , is defined which is equal to the total generated power divided by the total dissipated power. The values of  $\eta$  are numerically evaluated for a particular body cross section for various flight velocities and altitudes. The results indicate this type of generator can successfully operate at flight speeds corresponding to Mach numbers over 22 at altitudes of 30 to 50 miles. The successful operation of this generator at lower flight speeds can be realized by introducing an easily ionizable substance into the high temperature air near the stagnation point on the body, following the scheme outlined in Reference 6. With sodium as an ionizing element the generator can be operated at velocities over Mach 14 at altitudes of 30 to 50 miles.

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117 pages. \$1.50. Mic 56-3476

**THE INFLUENCE OF ULTRASONIC VIBRATIONS  
ON NUCLEAR MAGNETIZATION IN SODIUM CHLORIDE**  
(Publication No. 18,510)

Wesley Arthur Robinson, Ph.D.  
University of Washington, 1956

The point charge model for quadrupole relaxation in cubic crystals of Van Kranendonk has been studied experimentally. Ultrasonic energy at twice the Larmor frequency of  $\text{Na}^{23}$  in NaCl was introduced into single crystals of halite and optical quality NaCl. A decrease in nuclear magnetization was observed by use of pulsed nuclear magnetic resonance techniques. It was found that the charges in the model must be 1 to 3 times the electronic charge in order to explain the magnitude of this effect. The spin-lattice relaxation time in these samples was measured to be 7.5 seconds. This relaxation time can be explained if the charges of the model are  $\sim 50$  times the electron charge. The difference of these values is discussed. A by-product of these measurements is the phonon relaxation time for 9.5 Mc/sec. sound in NaCl. This was measured by a new technique involving the extent of the decrease in nuclear magnetization when the sound is allowed to escape the sample into oil at a known rate. The value obtained is  $0.36 \pm .10 \times 10^{-3}$  seconds.

The line width of the decrease in magnetization is related to the density of dislocations in the halite sample. The density found agrees reasonably with values from other sources.  
50 pages. \$1.50. Mic 56-3477

**THE POLARIZATION OF SMALL ANGLE X-RAY SCATTERING FROM COLD WORKED METALS**

(Publication No. 19,150)

Maurice Barnett Webb, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William Beeman

In previous work the diffuse small angle X-ray scattering from cold worked metals has been ascribed to one of two processes. Blin has proposed that the scattering is due to cavities in the metal and Neynaber has proposed that it is due to a double Bragg reflection mechanism. Here it is concluded that the double Bragg process does make an important contribution but that neither process by itself can explain all the experimental observations.

*The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.*

An approximate calculation of the total flux expected from the double Bragg processes has been made. In this calculation it is assumed that upon cold work the grains of a polycrystalline metal break up into slightly misoriented sub-grains. For moderately cold rolled nickel, with reasonable choices for the dimensions, misorientations, and coefficient of reflection of the sub-grains, the calculation gives a total scattered flux of  $4 \times 10^3$  counts/sec. The measured fluxes for three Ni foils rolled 15, 28 and 47% are about  $7 \times 10^3$  counts/sec. The agreement is within the accuracy of the calculation. It is concluded that the double Bragg process should make an important contribution.

It is shown that, for the double Bragg process,  $\theta f(\theta)$ , where  $\theta$  is the scattering angle and  $f(\theta)$  the scattering curve, is roughly the distribution of tilt angles among the sub-grains of one original grain. The observed functions  $\theta f(\theta)$  have halfwidths at half maximum of the order of  $1^\circ$  and the widths increase slowly with the amount of rolling. This result is in general agreement with the presently accepted model for the cold worked state.

The double Bragg process requires that the scattered radiation be polarized. It is calculated that, if the whole scattering is due to this process, the observed polarization ratio of the scattered beam should be 3.4. The direction of the strong electric vector should be radial in the scattering pattern.

The polarization has been measured by successive reflections of the scattered beam from an auxiliary crystal first in the vertical and then in the horizontal plane. It is found that the radiation scattered at  $1^\circ 30'$  is definitely polarized in the sense predicted but that the polarization ratio is smaller than predicted.

The polarization was found to be a function of deformation. The ratio ranges from near 3.1 for deformations less than 10% to approximately 1.5 for deformations near 50%.

It is concluded that at small deformations and small scattering angles the double Bragg process is of major importance but that at large deformations and scattering angles some other mechanism, perhaps cavity scattering, is more important.

Intensity considerations made it impossible to measure the polarization ratio as a function of angle and hereby separate the two contributions quantitatively.

All the observed features of the scattering can be qualitatively explained on the assumption that both of these mechanisms operate. 102 pages. \$1.50. Mic 56-3478

**SPECTRAL EMISSIVITIES AND LATTICE PARAMETERS OF IRON-COBALT ALLOYS**

(Publication No. 19,151)

Donald Lawrence White, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Dr. H. B. Wahlin

The spectral emissivities and lattice parameters of a series of iron-cobalt alloys was determined as a function of the temperature. An optical pyrometer was used to compare the apparent temperature of the metallic surface against the true temperature determined from a black

body radiator built into the sample, thus providing the two quantities needed to calculate the emissivity.

The four wave lengths used in the emissivity determinations were 6700 A.U. (Angstrom Units), 5900 A.U., 5500 A.U., and 5090 A.U., or red light, yellow light, green light and blue-green light respectively. The lattice parameters of these same alloys were determined by X ray diffraction.

The alloys used were 80 percent (atomic percent) cobalt-20 percent iron and 95 percent cobalt-5 percent iron. These particular alloys were chosen because they all have a great similarity in their physical characteristics and yet behave differently at the magnetic transformation, also called the Curie point. As the temperature is raised through the Curie point the 80 percent cobalt-20 percent iron alloy contracts and the 95 percent cobalt-5 percent iron alloy displays almost no volume change. These characteristics were desired to test an observation by Dr. H. B. Wahlin, University of Wisconsin, that when a metal goes through a sudden volume change, there is a sudden emissivity change. The emissivity of the denser phase is smaller than that of the lighter phase. This effect had been observed at both the alpha-gamma and gamma-delta transformations of iron and the Curie point in cobalt.

The ideal test of this principle would be to make a metal expand and contract by various amounts at a constant temperature and observe its emissivity as a function of density. Such an experiment is impossible. But by using the alloys mentioned above it is possible to have various types of volume changes without greatly changing the constitution of the metal.

The results of this experiment tend to verify the principle under test, but the emissivity change does not seem to depend upon the volume change in any simple manner. Neither an emissivity change nor a volume change was observed at the Curie point of the 95 percent cobalt-5 percent iron alloy. As the temperature of the 80 percent cobalt-20 percent iron alloy was raised through the Curie point, a volume contraction of 0.83 percent produced an emissivity decrease of about 6 percent.

63 pages. \$1.50. Mic 56-3479

#### PROPAGATION OF THE EFFECTS OF WALL INTERACTION IN THE RAREFACTION REGION OF SHOCK TUBE FLOW

(Publication No. 19,368)

Albert Charles Williams, Ph.D.  
Lehigh University, 1956

A method for computing the effects of wall friction and heat flow upon the flow parameters in the rarefaction region of the shock tube is presented. The one dimensional equations of continuity and of motion, and the equation of state are written to include the wall forces and heat flow. When the magnitudes of these dissipative effects as well as their dependence upon the flow parameters are given, the amount of the modification of the centered rarefaction wave ordinarily assumed in the ideal shock tube theory can be calculated. In the absence of any information on friction and heat transfer in such highly transient flows, expressions representing steady state turbulent flows are employed.

This leads to simultaneous integral equations of an unusual type in that they contain the unknowns of the equations in the expressions for the integration paths, as well as containing them under the integral sign. These are then solved by a successive approximation method. The equations can be interpreted physically as describing the propagation of signals along characteristic lines; the totality of all signals arriving at a given point in the  $x, t$  plane determines the flow parameters at that point.

The results are expressions for the deviations from ideal of the flow variables as functions of the initial density, sound speed and viscosity of the chamber gas as well as of the hydraulic radius of the tube. The calculations have been carried out for a gas whose specific heat ratio  $\gamma$  has value 1.4, although the method is applicable to other values of  $\gamma$  as well.

The computed values of the deviation of the density from ideal agree to within 5-10% with the measurements of Mack (Lehigh Univ., Inst. of Res., Tech. Rept. 4, 1954) except near the diaphragm position, where the difference increases to about 30%. This means that the actual density in the rarefaction can be computed to within 3%.

95 pages. \$1.50. Mic 56-3480

#### PHYSICS, ELECTRONICS AND ELECTRICITY

##### EXPERIMENTAL INVESTIGATION OF THE ELECTROCAPILLARY ACCELEROMETER

(Publication No. 19,288)

Guntis Kuskevics, Ph.D.  
University of Cincinnati, 1956

An instrument was introduced in ballistocardiography based on a new phenomenon called U-effect II. This effect produced an alternating voltage between the electrodes of an element consisting of a glass capillary filled with alternate drops of mercury and an electrolyte, when this element was subjected to an alternating acceleration. Preliminary investigation showed that for a sealed element the output voltage varied as the square of the frequency at a constant amplitude, while it was a linear function of the displacement amplitude at a given frequency. Irregular changes in time and difficulty to obtain equal outputs from elements with similar geometry led to the discovery of a very large temperature dependence of the output of sealed elements because of the pressure changes caused by the differences in thermal expansion as was shown by the pressure curves of elements with one end sealed while pressure was applied at the other end.

The most important discovery was the fact that the output was increased about 1000 times if the liquid was allowed to move freely in a U-shaped capillary with both ends open. The voltage output was found to be a linear function of the displacement amplitude of the liquid relative to the glass at constant frequencies, but the frequency characteristic was between a quadratic and a cubic. The short circuit current output was found to be the most stable characteristic of the element and it did not depend

on the ratio of the lengths of the drops of mercury to those of the electrolyte for the same number of interfaces. For electrolytes  $H_2SO_4$ ,  $CuSO_4$ ,  $HCl$  and  $NaOH$  were tried and the only limitation of choice was the requirement that it should not appreciably react chemically with  $Hg$ . The elements changed in time depending on the electrolyte.

The outputs of elements with one and two interfaces (regular  $Hg$ -electrolyte- $Hg$  and inverted electrolyte- $Hg$ -electrolyte designs) showed importance of the  $Hg$ -electrolyte interface as compared to the streaming potential. Preliminary investigation showed that the theory of Ueda, Watanabe and Tsuji did not agree with experiment quantitatively but these later results indicated that the output was not explained by the distortion of the interface, because the effect was so large and the distortion could not be detected from photomicrographs comparing the shape of the interface at the times of maximum acceleration. This conclusion indicated that U-effect II is different from the static electrocapillary effect which is based on the change of the radius of curvature of the interface and hence it could be called the dynamic electrocapillary effect.

59 pages. \$1.50. Mic 56-3481

#### PHYSICS, METEOROLOGY

##### EVALUATION OF THE PHYSICAL PROCESSES OCCURRING AT AND NEAR THE TROPOPAUSE

(Publication No. 18,515)

Dean Oden Staley, Ph.D.  
University of Washington, 1956

The major physical processes at and near the tropopause are evaluated. These processes are radiation, convection and turbulence, advection and vertical convergence. Radiation acts to smooth the temperature profile. Convection is infrequent and unimportant in establishing the tropopause. Turbulence will act to smooth the temperature profile unless flux has certain relationships to hydrostatic stability. Advection and vertical convergence cannot be universal mechanisms of tropopause formation. Nonconservative forces and diabatic temperature change are found to occur during a specific case of tropopause formation. It is suggested that turbulent enthalpy flux is divergent for positive curvature of the temperature profile and thereby creates a tropopause by increasing curvature of the temperature profile. Turbulent enthalpy flux is reformulated to verify that the flux can be divergent for positive curvature of the temperature profile.

130 pages. \$1.75. Mic 56-3482

#### PHYSICS, NUCLEAR

##### ELECTROSTATIC ANALYSIS OF NUCLEAR REACTION ENERGIES AND A STUDY OF $C^{15}$

(Publication No. 17,307)

Ross Alan Douglas, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor H. T. Richards

Accurate measurements of nuclear reaction energies by electrostatic deflection of incident and product particles in high resolution cylindrical and spherical analyzers have been made. Solid, thin ( $\sim 5 \times 10^{-8}$  atoms/cm $^2$ ), stable (at 200° C) targets were used with 2500 Å nickel backings. Nitrogen and deuterium targets were produced by chemical gettering of these gases by titanium in the Evapor-ion pump. Carbon 14 targets were prepared in a discharge tube containing acetylene (enriched to 28.8%  $C^{14}$ ). Targets of other materials were produced by standard evaporation techniques.

Measured reaction energies in Mev were:

$D(d, H^3)p$  ( $4.044 \pm 0.005$ );  $D(d, He^3)n$  ( $3.258^{+0.015}_{-0.007}$ );  
 $C^{14}(d, \alpha)B^{12}$  ( $0.362 \pm 0.002$ );  $C^{14}(d, p)C^{15}$  ( $-1.007 \pm 0.001$ );  
 $B^{10}(\alpha, d)C^{12}$  ( $1.341 \pm 0.002$ );  $O^{16}(d, p)O^{17*}$  ( $1.048 \pm 0.002$ );  
 $N^{14}(d, p)N^{15*}$  ( $1.308 \pm 0.002$ ,  $1.045 \pm 0.002$ ,  $0.296 \pm 0.001$   
and  $0.038 \pm 0.001$ );  $C^{12}(d, p)C^{13*}$  ( $-0.960 \pm 0.002$  and  $-1.130 \pm 0.002$ ) and  $N^{14}(d, \alpha)C^{12*}$  ( $3.928 \pm 0.012$ ).

Asymmetric errors are assigned to the  $D(d, He^3)n$  because of the 13 kev correction for contamination and the large asymmetric effect which results from the possible presence of wrinkles in the target. This effect is uniquely important for the reaction because of the unusual size of the contamination correction which is due to the large stopping power of the  $He^3$  ion and the kinematics of the reaction. By combining the  $D(d, H^3)p$  reaction energy with the known  $H^3(p, n)He^3$  reaction energy a value of  $3.280 \pm 0.005$  Mev is obtained for the  $D(d, He^3)n$  Q value.

The  $O^{16}(d, p)O^{17*}$  proton energy distribution had a shape which could be interpreted as the effect of target structure or of an 11 kev doublet in  $O^{17*}$ . If this is the effect of a doublet the Q value to the other state is  $1.037 \pm 0.003$  Mev.

An experimental width ( $\Gamma_{c.m.}$ , the width at half height) of  $0.035 \pm 0.008$  Mev for the 9.61 level in  $C^{12}$  was calculated from the energy distribution of the alpha particles. This width and Q imply the decay of the  $C^{12}$  level to  $Be^8$  by emission of an alpha particle. From the conservation of angular momentum and parity and use of the Wigner limit the possible spin and parity assignments of the  $C^{12*}$  level is restricted to  $0^+$ ,  $1^-$ ,  $2^+$ ,  $3^-$  and  $4^+$ . The  $4^+$  assignment implies maximum reduced width.

The measured  $C^{14}(d, p)C^{15}$  reaction energy differed by over 1 Mev from the previously accepted value. This discrepancy and the properties of  $C^{15}$  were investigated by means of appropriate scintillation spectrometers. A NaI(Tl) spectrometer was used to observe the decay of the induced activities resulting from deuteron bombardment of the  $C^{14}$  target. Above a deuteron energy of 1.3 Mev activities with half lives of  $2.25 \pm 0.05$  and  $7.5 \pm 1.5$  sec. were observed. Below this energy only the 7.5 sec. activity was observed. These were identified as  $C^{15}(2.25$  sec.) from the  $C^{14}(d, p)C^{15}$  reaction and  $N^{16}(7.4$  sec.), probably from the  $C^{14}(d, \gamma)N^{16}$ .

The energy threshold of the C<sup>15</sup> yield was found to be consistent with our measured Q value. Anomalies in the yield curve indicated N<sup>16</sup> states at 12.2, 12.6 and 12.8 Mev excitation.

The gamma ray spectrum measured with the NaI(Tl) spectrometer indicated only a single 5.3 Mev transition. The sum of the intensities of other possible gamma rays was less than 15% of the 5.3 Mev transition.

The beta ray spectrum obtained with a plastic scintillator was found to be composed of two components with an intensity ratio of four to one favoring the lower energy beta. Measured end point energies were 9.5 ± 0.3 and 4.5 ± 0.2 Mev, which are also consistent with the observed Q value and the gamma ray spectrum.

Bartholomew et al. have identified a T = 3/2 J = 1/2, even parity level in N<sup>15</sup> at 11.62 Mev excitation. After correction for the coulomb energy and the neutron-proton mass difference this level is found to be within 250 kev of the C<sup>15</sup> ground state and hence apparently the isobaric analogue. The information from the beta decay is also consistent with an assignment of spin 1/2 and even parity for the C<sup>15</sup> ground state. 140 pages. \$1.85. Mic 56-3483

This matrix element is a function of the incoming photon wave length but its energy dependence at low energy is known to within a constant parameter.

The S - wave photoproduction matrix element thus contains two constant parameters: the Kroll - Ruderman coupling constant arising in connection with the direct photo - ejection, and a matrix element between bound states of the nucleon arising in connection with the photo - excitation process.

The P - wave photoproduction is assumed to occur entirely through photo - excitation of the well known ( $\frac{3}{2}$ ,  $\frac{3}{2}$ ) state. The treatment is similar to the S - wave photo - excitation but involves two parameters corresponding to electric quadrupole and magnetic dipole transitions respectively.

Since no higher partial waves are taken into account the angular distribution has the form:

$$A + B \cos \theta + C \cos^2 \theta$$

Photoproduction of both neutral and positive pions from protons is treated, so that six functions of the energy are fitted with four constant parameters. The theoretical curves thus obtained are compared with experiment.

104 pages. \$1.50. Mic 56-3484

#### THEORY OF PHOTOPION PRODUCTION FROM NUCLEONS

(Publication No. 19,081)

Jacob Enoch, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Robert Sachs

The photoproduction matrix element is analyzed in terms of a resonance theory of pion nucleon scattering developed by Sachs. The transition amplitude is shown to be the sum of contributions from various physical processes.

The S - wave photoproduction matrix element is dominated by two processes: direct photo - ejection and photo - excitation of a resonance state. The direct photo - ejection process can be described as the absorption of a photon accompanied by the ejection of a pion from the pion "cloud" surrounding the core of the nucleon. The direct photo - ejection term is calculated by two methods. The first method employs the Siegert theorem which permits the calculation of electric-multipole matrix elements, in the long wave length limit, without the use of a detailed current operator--only the initial and final state must be known. The second method is a detailed weak - coupling finite source calculation with non-relativistic gradient coupling. Here a definite form for the current operator must be assumed. The results of the two calculations are very similar at low energies with deviations entering at higher energies particularly for small values of the cutoff parameter. Comparison with experiment shows that the direct photo - ejection process cannot account for the entire S - wave cross - section implying that the resonant photo - excitation term is needed. The photo - excitation matrix element is a product of two factors. One is a known function of the outgoing pion momentum, and is related to the pion nucleon S - wave phase shifts; the other factor is a matrix element of the interaction with the electromagnetic field between bound states of the nucleon.

#### A 4π BETA-RAY SCINTILLATION SPECTROMETER AND THE BETA SPECTRUM OF CHLORINE-36

(Publication No. 17,961)

Richard Gene Johnson, Ph.D.  
Indiana University, 1956

A 4π beta-ray scintillation spectrometer which is capable of utilizing large source areas has been built and tested for linearity and stability. The source is mounted between two plastic scintillators and each scintillator viewed with a photomultiplier tube. The output pulses from the two photomultipliers are added. The plastic scintillator is shown to have a linear energy response to electrons in the range from 60 kev to 1 Mev, and the percentage of electrons which are diffusely back-scattered from the plastic scintillators is found to be about 25% in the region from 400 kev to 1 Mev. To demonstrate the reliability of the scintillation spectrometer, the beta spectra of several pure beta emitters whose spectral shapes are known from magnetic spectrometer measurements have been investigated.

This 4π scintillation spectrometer has been used to measure the negatron spectrum from the twice forbidden decay of Cl<sup>36</sup>. The earlier magnetic spectrometer and proportional counter measurements did not agree on the shape of the spectrum at low energies. An analysis of the magnetic spectrometer data using the low-Z approximation of the twice forbidden shape factor for the pure tensor interaction gave  $A_{ij}/T_{ij} = 4.2$ . A similar analysis of the proportional counter data gave  $A_{ij}/T_{ij} = 5.1$ . The present data were taken with good statistics down to 89 kev and with a full-width resolution for the spectrometer of about 11.5% for the 624 kev internal conversion electrons from the Cs<sup>137</sup> decay. Corrections to the spectrum for the resolution of the instrument were less than 2% except for points

near the endpoint of the spectrum. The shape of the spectrum agreed quite well with the proportional counter measurements which extended down only to 180 kev.

The present data were analyzed using the "exact" twice forbidden shape factor for a linear combination of the scalar and tensor interactions. The ratios of nuclear matrix elements appearing in the theoretical shape factor were treated as free parameters and were varied to obtain the best agreement between the theoretical shape factor and the experimental shape factor. The best agreement was found for  $R_{ij}/T_{ij} = 0$  and  $A_{ij}/T_{ij} = 14.2$ . Since  $R_{ij}/T_{ij} = 0$ , the shape factor for the pure tensor interaction with  $A_{ij}/T_{ij} = 14.2$  is sufficient to fit the experimental data. An explanation is presented for the large discrepancy between this value for  $A_{ij}/T_{ij}$  and the values found by previous investigators using a low-Z approximation of the shape factor for the pure tensor interaction.

113 pages. \$1.50. Mic 56-3485

sections for the inverse reaction by detailed balancing. Compound nucleus spins and partial widths are calculated using  $N^{14}(n,n)N^{14}$  absolute cross section data reported previously.

Five resonances were observed in the  $C^{14}(\alpha,n)O^{17}$  reaction between 2.3 and 3.6 Mev. Resonance energies  $E_o$ , and half-widths  $\Gamma$ , both in kev, are:  $2553 \pm 4, 1.6 \pm 1; 2642 \pm 3, 10 \pm 1; 2798 \pm 11, 22 \pm 10; 3335 \pm 15, 100 \pm 20; 3508 \pm 4, 54 \pm 3$ . The differential cross section at  $0^\circ$  at the 2642-kev resonance is 31 mb/steradian  $\pm$  60 percent. An angular distribution taken at this resonance leads to a total cross section of 300 mb and an assignment of either  $1^-$  or  $3^-$  for the spin and parity of the corresponding level in the compound nucleus.

An Appendix presents a method for evaluating resonance data so as to get target thickness and natural width from measurements of observed width, peak yield, and yield summed across the resonance.

55 pages. \$1.50. Mic 56-3486

#### NEUTRON THRESHOLDS AND YIELDS FROM PROTON AND ALPHA BOMBARDMENT OF CARBON 14

(Publication No. 19,135)

Richard Mark Sanders, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Hugh Richards

The  $C^{14}(p,n)N^{14}$  and  $C^{14}(\alpha,n)O^{17}$  thresholds and excitation curves, and the angular distribution of one resonance in  $C^{14}(\alpha,n)O^{17}$ , were observed with the University of Wisconsin electrostatic generator. Carbon targets containing 38.7 percent  $C^{14}$  were prepared by running a glow discharge in acetylene, the target backings forming the electrodes. The resulting targets were very stable but contained microscopic non-uniformities in thickness. Neutrons were detected by a conventional long counter, by a scintillation counter using a boron-loaded phosphor, and by the counter-ratio technique of Bonner for thresholds. Beam energies were measured with an electrostatic analyzer calibrated with the  $Li^7(p,n)Be^7$  threshold. The calibration constant was observed to shift, presumably with temperature, by amounts of the order of 0.1 percent. This shifting was taken into account in the threshold measurements. Precautions, including the exclusion of organic materials from the target chamber, were taken to avoid  $C^{12}$  contamination of the  $C^{14}$  targets.

Thresholds (reaction energies in parentheses) measured in kev are:  $C^{14}(p,n)N^{14}, 671.5 \pm 0.5 (-626.4 \pm 0.5); C^{14}(p,n)N^{14*}$  (first excited state of  $N^{14}$ ),  $3149.6 \pm 1.1 (-2938.3 \pm 1.0); C^{14}(\alpha,n)O^{17}, 2340 \pm 3 (-1820 \pm 2)$ . The counter ratio technique was used for the  $C^{14}(\alpha,n)O^{17}$  as well as the  $C^{14}(p,n)N^{14*}$  threshold because of the weak yield and the neutron background from  $C^{13}(\alpha,n)O^{16}$ .

The excitation curve for  $C^{14}(p,n)N^{14}$  was studied from 0.67 to 3.4 Mev. Ten resonances were observed, including one, not previously reported, at  $2908 \pm 4$  kev with a natural width of  $71 \pm 5$  kev. Resonance energies for the remaining nine agree well with previous results but the half-widths are in general larger, perhaps due to the method of estimating target thickness. Measured absolute cross sections are in fair agreement with absolute cross

#### THE MONOENERGETIC BOLTZMANN TRANSPORT EQUATION OF NEUTRONS IN CYLINDRICAL COORDINATES

(Publication No. 19,289)

Harold Schneider, Ph.D.  
University of Cincinnati, 1956

The steady state monoenergetic Boltzmann Transport Equation has been solved for the flux distribution of neutrons diffusing in media of given nuclear properties and involving cylindrical symmetry. The spatial dependence of the transport flux is specified by the radial coordinate and the velocity dependence by two angular coordinates, chosen in such a manner as to yield the 4 simultaneous flux differential equations of rectangular geometry transport theory, in the limiting case when the radius of the cylinder approaches infinity. Scattering is assumed to be spherically symmetrical in the center of mass system of the neutron and nucleus.

The transport flux is expanded into spherical harmonics with the coefficients functions of the radial coordinate. The  $P_s$  approximation is utilized wherein only the first 6 independent non zero flux components are retained. This gave rise to 6 simultaneous 1st order differential equations with variable coefficients when substituted into the transport equation or 3 equivalent 2nd order equations, or diffusion approximation arises as a special case by retaining only the first two terms in the spherical harmonics expansion.

The exact analytic solution of the  $P_3$  approximation was obtained and the boundary conditions to be imposed upon the solution were formulated for identical periodic multi-regioned units called "cells" which find important applications in nuclear reactor design. The boundary conditions give rise to 6 simultaneous algebraic equations for the 6 arbitrary constants of each region present.

The more accurate transport approximation substantially differs from the diffusion approximation within a few neutron mean free paths of boundaries or sources where strong anisotropic directional effects arise in the neutron flux, requiring the application of transport theory.

The preceding analysis is limited primarily by the lumping of all of the neutrons into one energy group and treating the flux as spatially dependent on the radial coordinate only. Removal of these restrictions would lead to considerable complications that remain to be investigated.

The assumption of monoenergicity is valid for thermal neutrons or when the media consist of nuclei of large atomic mass relative to hydrogen, in which case the energy loss per collision suffered by the scattered neutrons can be neglected. For hydrogenous media the errors introduced by neglecting energy losses can be appreciable, but in either case, transport theory is more accurate than diffusion theory.

49 pages. \$1.50. Mic 56-3487

#### "INNER BREMSSTRAHLUNG" STUDIES IN Cs<sup>131</sup> AND EVIDENCE FOR "SHAKE UP" ELECTRONS IN Be<sup>7</sup>

(Publication No. 17,978)

Edward Albert Soltysik, Ph.D.  
Indiana University, 1956

Two less probable modes of electron capture decay are investigated in which the available nuclear energy is shared between the neutrino and either a photon or another orbital electron. The continuous radiation is called "inner bremsstrahlung," while the orbital electrons ejected are called "shake up" electrons.

The "inner bremsstrahlung" associated with the pure orbital capture decay of Cs<sup>131</sup> was carefully investigated with a NaI(tl) scintillation spectrometer. The source was placed 1.5 cm from the crystal with various amounts of intervening copper and tin absorbers to prevent pulse pile-up effects due to the intense Xe<sup>131</sup> X-ray. The spectrum was run ten times with different combinations of absorber thicknesses. The observed spectrum was corrected to zero absorber thickness, and for the finite resolution of the spectrometer, and detection efficiency. The end point of the spectrum is 340 ± 15 kev. which corresponds to a Q value of 370 ± 15 kev.

A comparison of the experimental spectrum with the theory of 1S radiative capture as developed by Morrison and Schiff<sup>1</sup> and refined by Jauch,<sup>2</sup> indicates relatively good agreement for photon energies greater than 200 kev., but

below this the observed spectrum deviates markedly from the theory. However, a calculation is made, based upon the idea of Glauber and Martin,<sup>3</sup> in which it is assumed that a 2P → 1S radiative transition following a 1S capture contributes to the photon spectrum. The good agreement between the experimental curve and this calculation seems to support their idea.

A search for "shake up" electrons associated with the orbital capture decay of Be<sup>7</sup> was made with a 180° shaped field magnetic spectrometer. Two distinct sources were prepared by different chemical procedures to insure source purity. Source #1, prepared by a chloroform extraction, had a surface density of .4 mg/cm<sup>2</sup>, while source #2, prepared with both a chloroform extraction and an 8 hydroxyquinolinate fractionation, had a surface density of 2 mg/cm<sup>2</sup>. Both sources revealed an identical continuous electron spectrum with an end point between 730 kev. and 900 kev., and a total probability of about  $3 \times 10^{-4}$  electrons per disintegration for electrons with energy greater than 45 kev.

Careful check of the half-life indicated that with both sources the electrons observed are to be associated with a half-life of 53 days. Controlled experiments with the second source ruled out the possibility that the observed electrons arose from extraneous scattering of the very intense 479 kev. gamma ray in Li<sup>7</sup>.

A comparison between the observed electron spectrum with the prediction of Primakoff and Porter<sup>4</sup> for the "shake up" process shows a marked difference. The theory predicts that most of the electrons are emitted at the K binding energy of beryllium, while the observations of this experiment indicate about 40 times too many higher energy electrons with no definite evidence of a sharp low energy rise.

It is concluded that the observed electrons arise from an alternate mode of decay of Be<sup>7</sup> with the available energy shared between the neutrino and the observed orbital electrons. It is further suggested that a new formulation of the "shake up" theory is necessary to accurately explain the spectrum observed.

95 pages. \$1.50. Mic 56-3488

1. P. Morrison and L. I. Schiff, P. R. 58, 24 (1940)
2. J. M. Jauch, ORNL-1102, (1951)
3. R. J. Glauber, and P. C. Martin, P. R. 95, 572 (1954)
4. H. Primakoff, and F. T. Porter, P. R. 89, 930 (1953)

#### PHYSIOLOGY

#### A HISTOPHYSIOLOGICAL STUDY OF OSMOTIC REGULATION IN THE EURYHALINE TELEOST FUNDULUS HETEROCЛИTUS

(Publication No. 19,153)

John Albert Bergeron, Ph.D.  
Cornell University, 1956

The osmoregulatory demands for marine and fresh water life are diametrically opposed. This study concerns

the mechanisms that enable Fundulus heteroclitus to adapt to either environment. Special attention has been given to the role of extra-renal salt transport and the presumed effectors, the "Chloride cells" of the gills.

The relationship between the internal osmotic pressure ( $\Delta_i$ ), "drinking" and the external osmotic pressure ( $\Delta_e$ ) has been studied in specimens adapted to a wide, graduated range of sea water dilutions ( $\Delta_e$  .01 - 1.77°C.). A cytological and cytochemical study of activity in the "Chloride cells" and in the preoptic-neurohypophysial system was

integrated with the study of these three factors. In addition, autoradiography was employed in an attempt to establish the branchial locus of  $\text{Cl}^{36}$  transport.

A refinement of the Drucker and Schreiner (1913) micro-method proved adequate for measuring the freezing point depression ( $\Delta_f$ ) of .02 ml. samples of heparinized plasma. "Drinking" was measured qualitatively in terms of the relative amount of colloidal carbon present at autopsy in the intestine of adapted specimens after an exposure to media tinctured with India ink for 24 hours. The adaptive response of the "Chloride cell" was characterized further by study of the nucleus, nucleolus, mitochondria and the "Golgi Element." In addition, a number of cytochemical methods were employed to gain information about the presence and distribution of the following substances; glycogen, acid mucopolysaccharides, glycoproteins, glycolipids, triglycerides, phospholipids, plasmalogen, cholesterol and its esters, Ribonucleic acid and Deoxyribose nucleic acid. A degree of protein identification was obtained by pH characterization of acidic and basic dye binding under controlled conditions. The histochemical demonstration of Carbonic anhydrase activity was accomplished by a modification of Kurata's (1954) procedure. The neurosecretory activity of the preoptico-neurohypophysial system was judged by E. Scharrer's (1942) criteria, and an estimate was made of colloid content. The nervous innervation of the branchial epithelium was studied by the Bodian protein-silver method. An autoradiographic technique was designed to meet the necessary conditions of high resolution and *in situ* retention of the water soluble isotope. Initial loss and redistribution is minimized.

The cytological and cytochemical results show that the "Chloride cell" is an active secretory cell in which a characteristic reversal of polarity occurs after transfer of fish from fresh water to sea water and vice versa. The activity appears to be cyclic and several phases can be distinguished in both adaptations.  $\text{Cl}^{36}$  autography did not establish the locus of transport because the specific activity in the tissue was not high enough to overcome the rate of background development.

The average internal osmotic pressure ( $\Delta_i$ ) was  $.75^\circ\text{C}$ . over the range of external osmotic pressures studied ( $\Delta_o$ ,  $.01$ - $1.77^\circ\text{C}$ .). The inversion of "Chloride cell" morphology occurs at  $\Delta_o$ ,  $.04^\circ\text{C}$ . and "drinking" persists to  $.03^\circ\text{C}$ .

The results have been interpreted as follows: in hyperosmotic media ( $\Delta_o$ ,  $.75$ - $1.77^\circ\text{C}$ .), the typical marine osmoregulatory pattern exists. Small amounts of nearly isoosmotic urine are formed and extra-renal salt excretion is necessitated because salt absorption is an inevitable consequence of "drinking" to restore water. In very dilute media ( $\Delta_o$ ,  $<.03^\circ\text{C}$ .), Fundulus regulates like a typical fresh water teleost; "drinking" is negligible, a copious amount of very dilute urine is produced, and branchial absorption of salt occurs. In the intermediate hypo-osmotic range ( $\Delta_o$ ,  $.04$ - $.75^\circ\text{C}$ .), "drinking" occurs and now functions as a salt source more than adequate to compensate for osmotic inflow of water. Consequently excess salt is excreted extra-renally. It follows, that the major mechanism responsible for salt replacement in this range is the ability of the kidney to form urine sufficiently dilute that the intestinally-absorbed salt results in net salt gain.

114 pages. \$1.50. Mic 56-3489

## EFFECTS OF SODIUM AND POTASSIUM IONS ON REPOLARIZATION IN FROG VENTRICULAR FIBERS

(Publication No. 17,117)

Allan Jordan Brady, Ph.D.  
University of Washington, 1956

This investigation reports studies aimed at elucidating the changes in membrane conductance which underly the action potential of frog ventricular muscle. The technique of intracellular recording with fine capillary electrodes has made possible detailed, quantitative studies of the ionic basis of membrane action potentials. The ventricular action potential has a thousand-fold greater duration than nerve action potentials. The ionic basis of electrical activity of nerve is well understood, but the ionic conductance changes causing the prolonged action potential of cardiac muscle are not known. The method of study was to determine the effects of changes in the ionic composition of the external bathing medium on the duration and shape of the action potential in an attempt to ascertain the membrane conductance changes responsible for the electrical activity.

The ventricle of a frog was excised and perfused with a Ringer's solution whose sodium and potassium concentrations had been altered. If, during the action potential, an ion moves along its electrochemical gradient and exerts no effects on membrane conductance *per se*, then it would be expected that an increase in the external concentration of a cation would increase the duration of the action potential. This prediction holds roughly for sodium ions; the duration of the action potential is directly proportional to external sodium. However, an increase in external potassium ion concentration has an opposite effect.

The whole ventricle was stimulated simultaneously by applying a brief current pulse across the wall. Consequently, the total membrane current is zero and membrane ionic current must be proportional to the time derivative of the membrane potential. The effects of sodium concentration on ionic current are as expected. An increase in external potassium produces a large increase in net outward ion flow in the latter phases of repolarization, contrary to expectation.

Unsuccessful attempts were made to measure total conductance changes associated with electrical activity across the ventricular wall. As a result, sodium and potassium conductances were estimated on the basis of impedance data derived from Purkinje tissue. The results of this analysis show that the membrane conductance changes during activity are dependent on membrane potential and ionic composition, particularly potassium but not on time. The hypothesis best explaining the present results is that the late, rapid repolarization results from an increased outward active transport of sodium ions.

118 pages. \$1.50. Mic 56-3490

**ELECTROLYTE AND WATER METABOLISM  
IN MALE CHICKENS**

(Publication No. 19,073)

Keith Irwin Brown, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Dr. R. K. Meyer

**I. STATEMENT OF THE PROBLEM**

The adrenal gland has been said (Selye, 1937, and others) to play an important role in the resistance of the animal to environmental stress. To evaluate the role of the adrenal gland of the bird in resistance to stress it is necessary to gather information concerning the physiology which the adrenal gland appears to regulate.

To obtain such information a study of electrolyte excretion and serum concentrations was made on intact, hypophysectomized and adrenalectomized birds. The emphasis of this study was placed upon the endocrine regulation of electrolyte and water balance under these experimental conditions.

**II. PROCEDURE**

For studies on electrolyte and water metabolism to be meaningful it became necessary to develop a method for obtaining 24-hour, feces-free urine samples. The method used was that of Hester, Essex and Mann (1940), which consisted of surgically exteriorizing the ureters, and attaching a funnel and rubber balloon in such a manner that 24-hour urine samples could be obtained. Surgery on the cloaca undoubtedly constituted a stress. A study of electrolyte and water balance following this surgery was considered to be a study of the response of the animal to stress.

Several days after surgery the excretory patterns ceased to fluctuate and remained constant. At this time the animal was considered to be relatively free from stress and the excretory patterns normal. During this period a study was made of the influence of adrenal cortical hormones and ACTH on intact and hypophysectomized birds.

Finally the general syndrome that resulted from adrenal insufficiency and the relative efficiency of various therapies in relieving this condition was studied.

**III. RESULTS AND CONCLUSIONS**

The stress of surgically exteriorizing the ureters produced a marked physiological response. There was a reduction in weight gains and an increase in excretion of electrolytes and nitrogenous wastes on days 3, 4, and 5 after the ureters were exteriorized. There was also a significant adrenal hypertrophy.

Hypophysectomy prevented both adrenal hypertrophy and physiological response to stress.

When ten-week old cockerels were treated with DCA, polyuria, polydipsia, sodium retention, possible potassium retention and an increase in thiocyanate space resulted.

Cortisone acetate caused loss in weight, polyuria and increased excretion of potassium, sodium, total nitrogen and uric acid. There was a slight decrease in thiocyanate space.

ACTH caused a decrease in weight gains and an increase in uric acid and total nitrogen excretion. Although there was no change in electrolyte excretion, the potassium and sodium released by tissue catabolism make it appear probable that there was actual retention of electrolytes by the kidneys.

Adrenalectomy caused reduced sodium, uric acid and total nitrogen excretion and reduced water intake. Just before death the birds' serum potassium was elevated and blood glucose was reduced.

DCA caused total nitrogen excretion and water intake to return to normal. Uric acid excretion was partially returned to normal but sodium excretion remained low. The serum potassium and blood glucose was normal.

Cortisone acetate caused all values to return to normal and total nitrogen to return to slightly above normal levels. Cortisone acetate-treated birds lost weight rapidly.

These data show that the adrenal physiology of the chicken and mammal have many similarities. The parallel sodium and potassium retention caused by DCA and excessive excretion caused by cortisone acetate was, however, in sharp contrast to the results reported for the mammal. The possibility that this phenomenon may be related to the fact that, under normal conditions, these birds excrete a hypotonic urine was discussed.

Data was presented and literature cited to support the postulate that the primary defect in electrolyte balance in adrenalectomized chickens is decreased respiratory energy and consequently a decreased efflux of sodium from the cells.

73 pages. \$1.50. Mic 56-3491

**METABOLIC ALTERATIONS IN RATS  
WITH ADAPTATION TO  
LOW ENVIRONMENTAL TEMPERATURES**

(Publication No. 18,493)

Walter Henry Cottle, Ph.D.  
University of Washington, 1956

The metabolic changes resulting from prolonged exposure to low environmental temperatures have been studied in male albino rats. Following the initial exposure to cold ( $5^{\circ}\text{C}$ ) animals showed a gradual increase in heat loss, oxygen consumption and food intake for 2 to 3 weeks. Metabolism at  $28^{\circ}\text{C}$  ( $\text{MR}^{28}$ ) was increased 20 per cent after 2 weeks at  $5^{\circ}\text{C}$ . After 2 weeks at  $5^{\circ}\text{C}$   $\text{MR}^{28}$  of thyroid-deficient rats (thyroidectomized and given 2.5 microgm. thyroxine per day) was also increased.

Determinations were made of the metabolic rate of muscle, liver and kidney *in vitro*. Only liver from the intact cold-adapted rats had a higher metabolism *in vitro* when compared to corresponding tissues of nonadapted rats. Tissues from thyroid deficient rats were unchanged by exposure to cold. The findings fail to support the suggestion that the increase in  $\text{MR}^{28}$  is a reflection of increases in the intrinsic metabolism of tissues.

Metabolic rates of rats paralyzed with curare were measured at  $30^{\circ}\text{C}$ . The differences between metabolic rates of cold-adapted and nonadapted rats measured under these conditions resembled that observed when metabolic rates of intact rats were measured at  $28^{\circ}\text{C}$ . Thus the increased  $\text{MR}^{28}$  apparently is not due to increased muscular activity or muscle tone of the adapted animals.

The ability of curarized rats to maintain body temperature when exposed to cold was tested. Cold adapted rats were able to increase heat production without an increase in muscular activity (chemical regulation) and maintained rectal temperature at or near its initial level. The limited increase by nonadapted animals was ineffective. Chemical regulation thus is enhanced by cold adaptation.

The increase in chemical regulation with cold adaptation accounts for the reduction in muscular activity which has been found in rats in the cold after adaptation. It would also account for the ability of the cold-adapted animals to increase heat production to the high levels necessary to withstand severe cold stress.

The postulation that chemical regulation is mediated by the release of epinephrine, and the finding that the calorogenic response to epinephrine is enhanced by cold adaptation, suggests the increase in chemical regulation may result from increased sensitivity to the epinephrine which is released on exposure to cold.

Adrenomedullation reduced the metabolic response of cold-adapted rats slightly suggesting that the response is mediated only in part by release of epinephrine from the adrenal medulla. Possibly the response is mediated by release of epinephrine from extra adrenal sources.

107 pages. \$1.50. Mic 56-3492

#### THE EFFECTS OF ACUTE CIRCULATORY INADEQUACY ON RENAL FUNCTION

(Publication No. 19,105)

Clyde Harding Kratochvil, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William B. Youmans

The effects of acute circulatory inadequacy on renal function have been studied using two separate techniques to produce an acute drop in the peripheral vascular resistance. Since a chronic decrease in peripheral vascular resistance is known to be associated with an increase in blood volume, the immediate response of the kidney to this type of stress was investigated.

In Part I of the thesis, 19 experiments were performed on mongrel female dogs. All were anesthetized with sodium pentobarbital. The first 14 dogs were hydrated with intravenous saline. The latter 4 also received atropine. Five additional experiments were performed on dogs hydrated with tap water via gastric tube. After three 20 minute control periods, two mgm. of acetylcholine (ACh) was injected intravenously at the beginning and mid-point of the fourth period. The animals were then studied for three additional 20 minute periods. The following measurements were made in each period: urine excretion; sodium excretion; sodium load; endogenous creatinine clearance; para-amino-hippurate (PAH) clearance. In the last five experiments, only urine volume was measured.

No marked suppression of urine flow upon the injection of ACh was observed. In 7 of 10 experiments a natriuresis and diuresis developed after the injection of the ACh. It is possible that this may be due to the natriuretic effect of the antidiuretic hormone liberated with the injection of the ACh. It is more likely attributable to the

water and salt loading present. The results with the 4 atropinized dogs were erratic. The 5 water hydrated dogs had a decrease in urine excretion with injection of the ACh in contrast to the saline hydrated animals. No evidence was obtained for the stimulation of the retention of sodium.

In Part II, the decrease in peripheral resistance was accomplished by creating an acute femoral arteriovenous fistula. This fistula was unilateral in 5 animals and bilateral in 16. Mongrel female dogs, anesthetized with sodium pentobarbital alone or in combination with morphine, and hydrated with saline or Ringer-Locke solution were used. The shunt flow in the bilateral fistulae was measured and found to be greater than 1100 ml. per min. in all experiments. The animals were usually studied for several 20 minute control periods before the fistula was opened and after it was closed. The following measurements were made: sodium load and excretion (unilateral fistulae only); endogenous creatinine clearance; PAH clearance; urine excretion; and cardiac output.

With the unilateral fistulae (with an estimated shunt flow of 800 ml. per min.) no evidence for the stimulation of sodium retention was found. With the bilateral fistulae, there was a decrease in urine excretion, a decrease in PAH clearance and a decrease in endogenous creatinine clearance. The decrease in PAH clearance was much greater than the drop in creatinine clearance. The filtration fraction was increased. PAH extraction ratios determined in 6 dogs demonstrated an average ratio of only 0.7 with a suggestion of a further drop during the time the shunt was open. Renal venous pressure as measured in three dogs did not increase significantly nor was there a significant decrease in renal artery to vein pressure gradient.

Evidence is presented which indicates that there is a greater degree of efferent arteriolar constriction than afferent arteriolar constriction within the kidney and that there is a greater total degree of vasoconstriction in the kidney than in the remainder of the peripheral vascular bed.

64 pages. \$1.50. Mic 56-3493

#### PHYSIOLOGY OF MAMMALIAN HIBERNATION

(Publication No. 19,107)

Barbara Ruth Landau, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Albert R. Dawe

The phenomenon of hibernation has been studied in the thirteen-lined ground squirrel. Natural hibernation is seen to be a cyclic phenomenon, recurring a number of times each hibernating season (winter). Each of these hibernating cycles consists of four phases: 1) induction, 2) the hibernating state, 3) arousal, and 4) the aroused or active state. Three different approaches have been taken: 1) factors affecting the tendency to hibernate in a colony of animals and in individuals, 2) cardiovascular, respiratory, and body temperature changes during the hibernating cycle, and 3) a tissue (the heart) of a hibernator.

Among the environmental conditions most favoring the hibernating state in a colony of animals was: 1) an ambient temperature between 5° and 7.5°C, and rising slightly,

2) a barometric pressure between 750 and 755 mm. Hg. Animals showed a greater tendency to hibernate in early winter (before February 1 in this series).

Heart rate, respiration, and fore and hind temperatures were recorded simultaneously during all phases of the hibernating cycle. From the information obtained, these phases have been described.

Induction, which is a marked decline of metabolic processes, usually follows a period of activity, but induction has been seen to begin during the arousal process. In the latter case it may proceed to the hibernating state, or may be only a temporary reversal of the arousal process.

In a deeply hibernating animal, respiration consists of irregularly spaced deep sighs, averaging about 1-3 per minute. The heart beat may be regular or irregular, or about 7-8 per minute. Arrhythmias may be associated with respiration, with slow bodily movements, or be of unidentified cause. Body temperature is from 3°-9° C., and stays slightly above that of the environment. Animals in the hibernating state may be at different depths. Those said to be "deep" are relatively insensitive to external stimuli, such as rotation followed by abrupt deceleration, sound, light, and sudden pressure changes. Animals said to be "shallow" are easily disturbed by such stimuli.

At the onset of arousal small rapid breaths appear, which replace the deep sighs. These increase in rate and amplitude, to a marked hyperventilation. Breathing rate increased to about 200 per minute and heart rate to about 400 per minute. Cardiac arrhythmias occur in late arousal, some of which are associated with respiration, some with external stimuli, but others are unexplained. The forepart of the animal warms before the hind part, resulting in a fore-to-hind temperature gradient, which at its maximum reaches about 15° C.

During induction and arousal, changes in respiration precede in time those of the heart rate, which in turn lead changes in body temperature.

Heart tissue separated from the brain by decapitation continues to beat for several hours at a slow rate, when the body is kept in the cold (5° C). Heart completely isolated and placed in unoxygenated saline of 5° C will also beat, but for a shorter period of time. In the isolated heart, electrical activity can be recorded after cessation of mechanical contraction. Thus, electrical discharge and contractile activity can be dissociated. This observation raises the question as to whether the heart of a deeply hibernating animal moves blood with each electrocardiographic record.

175 pages. \$2.30. Mic 56-3494

#### MECHANISMS OF RESPIRATORY RESPONSES TO CHANGES IN ARTERIAL BLOOD PRESSURE

(Publication No. 19,137)

Robert Thomas Schopp, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William B. Youmans

Respiration and blood pressure were recorded in anesthetized dogs before and after denervation of the carotid sinuses and aortic arch (sino-aortic denervation) during arterial hypotension induced by hemorrhage, injection of

urecholine and nitroglycerine, and stimulation of vagal efferent fibers, and during hypertension in part of the systemic arterial tree induced by occluding the abdominal aorta.

The animals in which the effects of hemorrhage were studied were anesthetized with morphine (3 mg. per kilo) and sodium pentobarbital (15 mg. per kilo). In all other experiments sodium pentothal and chloralose (70 mg. per kilo) were used for producing anesthesia.

**Responses to hemorrhage:** Eight of the 12 animals showed respiratory stimulation in response to bleeding. In four of the animals the respiratory stimulation was not present after sino-aortic denervation while in the other four it persisted.

**Responses to urecholine:** Four of the 8 animals showed mild respiratory stimulation during the fall in arterial blood pressure induced by injection of urecholine. The response was abolished in these animals by sino-aortic denervation.

**Responses to nitroglycerine:** Nine of the 17 animals showed mild respiratory stimulation during the fall in arterial blood pressure induced by injection of nitroglycerine. The response persisted after sino-aortic denervation in 7 of these animals. Nine of the 17 dogs were connected with a compensator to buffer the fall in blood pressure which occurred when nitroglycerine was given. In 3 of these animals the respiratory stimulation persisted after sino-aortic denervation but was abolished when the fall in pressure was buffered.

**Responses to efferent vagal stimulation:** Nine of 15 dogs showed immediate respiratory inhibition following faradic stimulation of the peripheral end of the sectioned right vagus nerve. The inhibition observed is not dependent upon the sino-aortic receptors since it was evident after denervation in 14 of the 15 dogs studied. In one animal the respiratory inhibition was not present after sectioning the spinal cord at C<sub>7</sub>.

**Responses to aortic occlusion:** All of the 13 dogs in the first group of this series showed immediate respiratory inhibition with only the right vagus nerve sectioned when the abdominal aorta was occluded above the celiac artery. After complete sino-aortic denervation the immediate respiratory inhibition was still evident in 11 of 13 animals. Delayed inhibition occurred in one of the other dogs. After transecting the spinal cord at C<sub>7</sub>, in one dog the respiratory inhibition, which was evident with only the right vagus cut, did not persist although a slight slowing of rate was apparent. The immediate respiratory response was also abolished in two dogs by eliminating the dorsal roots T<sub>1</sub> through T<sub>5</sub>.

It is evident from these experiments that two or more mechanisms are concerned in eliciting the respiratory responses induced by the various procedures. The respiratory stimulation induced by urecholine is apparently dependent upon the sino-aortic mechanism. The stimulation caused by bleeding and by nitroglycerine is not entirely dependent upon the sino-aortic mechanism. The respiratory inhibition resulting from peripheral vagal stimulation and from aortic occlusion are independent of the sino-aortic mechanism. The mechanism of respiratory inhibition which is independent of the sino-aortic mechanism involves receptors innervated below C<sub>7</sub>. The receptors probably are located in the thorax.

Changes in cerebral blood flow do not appear to be important in the production of the respiratory responses observed in these studies. 77 pages. \$1.50. Mic 56-3495

**A STUDY OF THE PARATHYROIDS OF HERBIVORA  
IN RELATION TO THE CALCIUM METABOLISM  
AND MILK FEVER**

(Publication No. 19,144)

Gerald H. Stott, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Vearl R. Smith

This study was undertaken to ascertain the primary cause of milk fever and to test methods of prophylactic treatment. In the initial phases of the study location and identification of the parathyroid glands were made on cattle slaughtered at the local abattoir. The size and cytology of the glands were correlated as nearly as possible to the known physiological status of the animal.

The Golgi element is known to be important in synthesizing cellular products. When the Golgi element was observed during a period of relative physiological inactivity of the parathyroid glands, simple granules were seen. Observations during periods of increased activity revealed double structured or vacuolated bodies which, with continued activity, became aggregated.

In young calves up to six weeks of age, only an occasional granule could be found in the cells. Most of the cells were chromophobic. With an increase in age the cells become more chromophilic and a greater number of granules were found. At maturity, both in males and females, vacuolated spheroids as well as the homogenous granules could be observed in most of the epithelial cells. All types of cells were represented--chromophobic, chromophilic, clear cells and oxyphile cells. During late pregnancy there was a great increase in the number of discrete sudanophilic granules and vacuolated bodies dispersed throughout the cells. Large clear cells were also prevalent. During lactation these bodies hypertrophied and formed large aggregates of vacuolated bodies in most of the cells. Gradually during lactation, the clear cells disappeared, probably forming actively secreting cells. Near the completion of lactation the aggregated bodies become dispersed, diminished in size and gradually disappear. In dry animals there was a new proliferation of clear and chromophobic cells.

When parathyroid tissue was taken from a cow with milk fever, it was found comparable to that from a heavily lactating cow, indicating a hypersecretion rather than a hyposecretion, as generally believed.

Sodium citrate was used in this study in an attempt to stimulate parathyroid activity in the bovine. Where citrate was injected intravenously for a period of ten days or over, changes in structure of the parathyroid epithelial

cells could be observed in calves and mature animals. Forty-six Jersey cows known to be subject to a high incidence of milk fever were treated with sodium citrate prior to parturition. Control animals were observed during the same period. The results suggested that sodium citrate may have been effective in preventing milk fever.

ACTH (250 I.U.) was injected into cows following parturition and a second injection followed in 12 hours. Parturition and each injection of ACTH resulted in leucocyte response--a decrease in lymphocytes and an increase in neutrophiles. The results did not support the theory that a highly active adrenal cortex of pregnancy and parturition brings on adrenal cortical exhaustion and resultant milk fever.

Dihydrotachysterol was administered to cows and goats. No significant changes in blood levels of calcium, magnesium and phosphorus were observed after the treatment.

Jersey cows having previous records of milk fever were treated with dihydrotachysterol a day or two prior to parturition. The treatments showed no therapeutic value in preventing milk fever, retarding its development or ameliorating the symptoms--all cows treated developed the disease.

Two pregnant goats were thyroidectomized and three were completely thyro-parathyroidectomized. Following the operations, thyroidectomized goats showed no abnormal symptoms, each giving birth to twins without complications. The three thyro-parathyroidectomized goats were first noticed to show symptoms of tetany one week following the operation. One goat aborted at this time. Calcium gluconate was needed to sustain the other two goats until after they kidded, when symptoms of parathyroid deficiency disappeared. Serum calcium decreased to a tetanic level after complete thyro-parathyroidectomy and remained so until after parturition when it increased slowly towards a normal level. Blood phosphorus dropped sharply after the operations and remained at subnormal levels.

In young calves thyro-parathyroidectomized, death ensued following acute tetany within 24 to 48 hours. Serum calcium precipitously dropped and phosphorus increased. Older calves were more tolerant of the operation.

Mature cows showed no outward symptoms to thyro-parathyroidectomy. Serum calcium and phosphorus both declined to subnormal levels in pregnant cows after the operation but then increased to near normal in a few days. There were no symptoms of milk fever at parturition.

It was concluded from these experiments that hypoparathyroidism is not the primary cause of milk fever but that some more basic condition exists.

187 pages. \$2.45. Mic 56-3496

## POLITICAL SCIENCE

### POLITICAL SCIENCE, GENERAL

#### THE FEDERAL EXCLUSIONARY RULE IN RELATION TO THE FOURTH AMENDMENT AS APPLIED AND INTERPRETED BY THE UNITED STATES SUPREME COURT

(Publication No. 18,570)

Louis Arthur Antrobus, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. John W. Schwada

This is a study in American constitutional law in relation to the search and seizure clauses of the Fourth Amendment with particular emphasis upon the origin, application, and evaluation of the federal exclusionary rule as formulated and applied by the United States Supreme Court.

The issues and points of view that make for a conflict in the interpretation of constitutional law in regard to the Fourth Amendment are drawn from a case study of the United States Reports (ranging from the Boyd case of 1886 to the Irvine case of 1954). Attention is given both to criticism and rejection of the Boyd-Weeks doctrine as well as to approval and acceptance of the federal exclusionary principle. Emphasis is laid upon the double trend of Court interpretation in dealing with the guarantees of the Fourth Amendment and the "reasonableness" of admitting or excluding evidence in keeping with the exclusionary doctrine.

In estimating the present-day force and effectiveness of the exclusionary principle, the author, after examination of the comments of the Justices themselves as reflected through the dicta bound up with each individual opinion, as well as through an examination of the comments of the leading publicists on the subject, reaches the conclusion that the continued application of the exclusionary doctrine still remains the most attractive alternative that has been devised up to the present time to buttress the individual liberties implicit under the Fourth Amendment and that there is little evidence to show that the exclusionary principle is in any immediate danger of abandonment.

243 pages. \$3.15. Mic 56-3497

#### PARTY AND VOTING BEHAVIOR IN THE PORTSMOUTH ATOMIC ENERGY ESTABLISHMENT AREA

(Publication No. 18,782)

Ira Ridgway Davis, Ph.D.  
The Ohio State University, 1956

In August, 1954, the Atomic Energy Commission announced its decision to construct a one billion, two hundred million dollar atomic energy plant in Pike County, Ohio.

At the peak of the construction phase, in the summer of 1954, over 22,000 persons were employed at the plant. The geographical scope of the study extended over four Ohio counties: Jackson, Pike, Ross, and Scioto. The principal purpose of the study was to examine the immediate influence which the atomic energy establishment might have on historic patterns of party and voting behavior in the area. The movement of a mass of people into the area for a three- to four-year period might be expected to pose a threat to the existing political complexion if they voted, since among their number were 12,000 to 13,000 potential voters.

A descriptive analysis of the initial phase of the plant's construction and the location of the new residents was undertaken, followed by a historical characterization of the four counties' organization and development. A historical and statistical analysis traced election results and trends from 1859 to 1952 for the offices of President, Governor, United States Senator, and United States Representative, in order to secure a view of the political culture and tradition which was the subject of the intrusion that began in 1952. The study included a detailed investigation of the general election of 1954, which formed the basis for such conclusions as could be reached at this stage of the atomic energy establishment's development. Party leaders were interviewed in the four-county area to determine their views and programs in regard to the newcomers. Also, trailer and registration records were perused to obtain data concerning the background of the newcomers who did register and vote.

The principal finding of the study was that the immediate effect of the newcomers on party and voting behavior was negligible. In essence the results indicated that: (1) the large number of migratory workers did not affect election results in the contests for Governor, United States Senator, and United States Representative on a county-wide basis in 1954, (2) the newcomers had a positive effect in a few isolated voting precincts, (3) there was definitely a lack of interest on the part of all voters and a small turnout in this off-year election, (4) political leaders in the area were unconcerned about the newcomers after registration ended and new residents had failed to register in large numbers, and (5) the potential new voters participated only to a limited extent even when prodded by local political organizations.

In conclusion, the four counties remained unchanged in their political complexion, and no major deviations developed as an immediate result of the influx. While the direct effects were negligible, the indirect effects may prove to be more positive in nature. An undetermined number of trade, service, and professional persons were drawn to the area, and these persons may pose a threat to party organizations in the future. Also, there remains a core of permanent operating personnel at the atomic energy establishment who may later influence party and voting behavior in the area.

330 pages. \$4.25. Mic 56-3498

**POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS**

**THE ROLE OF THE DIRECTOR IN THE DEVELOPMENT OF THE INTERNATIONAL LABOUR ORGANISATION**

(Publication No. 17,056)

John Stearns Gillespie, Ph.D.  
Columbia University, 1956

The International Labour Organisation was brought into being and formally defined in Part XIII of the Treaty of Versailles. To an unusual degree in comparison with the comparable officials of other international organizations the Directors of the International Labour Organisation have assumed a positive leadership that has contributed substantially to bringing the ILO to a position of pre-eminence among international agencies.

Albert Thomas of France, the first Director, was an individual of extraordinary personality, ability, and energy. Previous international experience had made him sensitive to the reactions of nations and individuals, permitting him boldly to seize the initiative in defining and expanding the jurisdiction of the Organisation.

Harold Butler of Great Britain succeeded Albert Thomas. Where Thomas had organized and improvised, Butler followed and consolidated, strengthening the administrative structure, and striving for greater universality of membership.

With the coming of World War II, John G. Winant of the United States became the Director. Influential associations in the United States, an imaginative intelligence and a sympathetic personality enabled him to make an unusual contribution in a period of stress. As the first wartime Director, during World War II, he brought the ILO out of Geneva to a position of security in Montreal and initiated the wartime reorganization of the Office without losing international support and interest in the Organisation's programs.

Edward J. Phelan, an Irish national but in early life associated with the English civil service, became Director in 1941 and to him fell the task of preserving the ILO during World War II and during the immediate post-war period when international society seemed intent on discarding all the institutions created at Versailles.

David Morse, of the United States, the present Director-General (the title having been expanded in 1946), has rationalized the internal organization of the Office, striving for an expanded geographical representation among the higher administrative officers on the one hand, and seeking the key personnel to make the manpower and operational programs more efficient on the other.

Certain conclusions may be drawn from an examination of the five Directorships:

1. ILO Directors have been unique in the dynamic quality of their leadership. They actually have been able to lead the way, introducing new programs on occasion and serving as the central point of coordination in the Organisation. It is suggested that this may be traced to the fact that the ILO Directors usually enjoy the continuing support of organized labor which provides a constant powerful basis of power denied to most international leaders.

2. The five Directors of the ILO have either been nationals of, or in their early careers positively associated

with a great power. A Director representing a great power reasonably may expect at least the support of his own country, when inaugurating a new international labor program.

3. Although it might seem reasonable to expect that the training areas of the great national civil services should provide the administrators for international agencies, this study suggests that the most dynamic directors of the ILO--Thomas and Winant--had political rather than civil service backgrounds. The present Director-General's background includes both political and bureaucratic experience.

4. Finally, it may be observed that the foregoing statement of the value of political as opposed to bureaucratic background as the best preparation for the leadership of this international agency confirms the general observation that international action continues to be based on national and group interests with all the possible attendant shifts of interpretation rather than upon long-term international policy developments. As long as this is so, the Director-General of the ILO should be primarily a political leader capable of bringing many national hopes and opposing employer and worker interests into a kind of synthesis, and then, secondly, an administrator and developer of the special programs entrusted to him. The extent to which he is able to accomplish both of these objectives will be the special measure of his uniqueness as a leader.

507 pages. \$6.45. Mic 56-3499

**THE STOCKPILING OF STRATEGIC MATERIALS:  
A STUDY OF CIVILIAN AND MILITARY  
PERSPECTIVES IN THE FORMULATION AND  
ADMINISTRATION OF NATIONAL SECURITY POLICY**

(Publication No. 17,082)

Glenn Herald Snyder, Ph.D.  
Columbia University, 1956

This is a study of the stockpiling of strategic materials since World War II, the chief purpose being to compare the attitudes and behavior traits of civilian and military participants. Chapters are devoted to the background of the Stockpiling Act of 1946, stockpile procurement from 1946 to 1950, organization and administration, the calculation of stockpile goals, alternative means to raw materials security, stockpiling under conditions of partial mobilization during the Korean War, and the current stockpile program.

After a long argument between the civilian and military agencies, Congress vested dominant policy control in the Army-Navy Munitions Board, relegating the interested civilian agencies to an advisory status. Stockpile procurement was hindered by high industrial demand immediately after the war (and by the Munitions Board's reluctance to compete aggressively against industrial buyers) and then, in 1949, by the failure of Congress to provide sufficient appropriations in time to take advantage of softening markets. The Munitions Board resisted pressures from civilian agencies, Congress, and private mining groups, to increase stockpile objectives and to make the program serve ends other than national security. During the Korean War, the civilian mobilization agencies acquired de facto

control over stockpile procurement. These agencies gave stockpiling a relatively low priority and tended to use the program to support other programs which were either more urgent, less flexible administratively, or more potent politically. Transfer of policy control to a civilian agency -- the Office of Defense Mobilization -- in 1953, was followed by further development of the stockpiling program as the servant of multiple ends -- including support of the domestic mining industry, relief of shortages and disposal of agricultural surpluses.

Civilian and military participants, both as agencies and as individuals, displayed certain significant differences in attitudes and behavior traits. For example, while the military departments wanted the stockpile program to serve only one objective -- national security -- and were reluctant to integrate it administratively with other related programs, civilian agencies (principally the Departments of State, Interior, Commerce, Agriculture, and the mobilization agencies) were inclined to inject nonsecurity purposes and to seek integration of stockpiling with other raw materials security measures.

The Munitions Board and the Joint Chiefs of Staff were inclined to interpret their roles broadly when the issue could be defined as involving purely national security considerations, but narrowly when the issue involved a choice between security and some other values, such as economic stability. Civilian agencies exerted the most influence on the latter issues. On balance, the civilian agencies were more inclined to "role imperialism" than were the military agencies. The civilian agencies were inclined to consider a wider range of contingencies and probabilities, especially those of a political nature, and were more willing than the military agencies to base planning on uncertainties. Military men showed less sensitivity than civilians to market conditions and costs. The Munitions Board was more inclined toward short-run economization in procurement planning than were either the civilian agencies or the other military agencies, a tendency which the civilian agencies deplored as "mechanical" and "rigid." Munitions Board personnel, civilians and military, often approached and described policy decisions as "correct solutions" rather than as "value choices." The Munitions Board considered itself more "practical" or "realistic" than the civilian agencies, and this attitude especially influenced its behavior toward Congress. Many of the contrasts in behavior and attitudes seemed to stem primarily out of differences in agency responsibilities, but others seemed more closely related to agency creeds and traditions, differences in agency vulnerability to pressures, professional loyalties and identifications, prior job experience of individuals, personality differences, and position of individuals on the "continentalist-internationalist" spectrum.

617 pages. \$7.85. Mic 56-3500

## POLITICAL SCIENCE, PUBLIC ADMINISTRATION

### FREQUENCY ASSIGNMENT ADMINISTRATIVE CONTROL

(Publication No. 16,952)

Donald R. MacQuivey, Ph.D.  
The American University, 1956

The study reported in this dissertation was undertaken in an effort to provide an answer to the question: "What are the characteristics of the optimum system for administrative control of radio frequency assignments in the United States and how can progress be made toward such a system?"

The author, as a member of the Telecommunications Division of the Department of State and a number of inter-departmental and Government/Industry committees, has been engaged for more than ten years with such problems of administrative control. During that time he became well acquainted with the persons concerned with radio-frequency assignment processes in all of the Government agencies and, particularly, with those represented on the Interdepartment Radio Advisory Committee (IRAC) and its subcommittees. The IRAC is the central organ of frequency assignment to Government radio stations. Although most of the detailed interagency and Government/non-Government checking of proposed radio frequency use to avoid interference is done by individual radio engineers within each Government agency and the Federal Communications Commission, the results of such checking must be brought into the regular meetings of the Frequency Assignment Subcommittee (FAS) of the IRAC for confirmation to assure that such checking is complete. The IRAC/FAS records are, therefore, the authentic source of information concerning such coordination efforts. Almost nothing has been published concerning this coordination process, particularly concerning that portion of it carried on within the various Government agencies. It seemed important that a study of these processes be made to determine their common characteristics and whether a control system might be developed to facilitate these operations.

The procedure followed in making the study was, first, to review the background of previous related studies and to review the history of telecommunications control organization in the United States. The basic technical characteristics of the radio-frequency spectrum as they affect the administrative process was also considered in order to draw conclusions relative to the limitations which these characteristics place upon freedom of action in the process. The actual workings of the process were then studied through extensive personal interviews with those actually involved in it within the various agencies. In the main, these persons were already well acquainted with the author through previous association.

As a result of the study it was possible to describe in the dissertation five administrative needs characteristic of the process: frequency requirement determination, frequency nomination, frequency clearance and assignment, collection of frequency usage information and assignment review. Of these needs, the first four are discussed in detail on an interagency basis. The last need receives attention principally in terms of what it seems should be done on an interagency basis. What is done is largely on

an individual basis within each agency. In considering these administrative needs and what might be done to meet them more effectively, five scientific management processes are applied: analysis of the existing situation, the development of statements of what is common practice, the development of what should become standard practice, relationship pre-planning (both functionally in the use of radio frequencies and organizationally among the persons and offices involved) and finally the development of procedures to facilitate operation of the control system.

The conclusions drawn from the study include a definition of an optimum frequency management system--that it is that frequency assignment administrative control system which permits the maximum usefulness of radio frequencies to be obtained by all the users and that administrative convenience is secondary in this consideration but is an essential part of the optimum system because, without it, maximum frequency usefulness cannot be obtained. The characteristics of such an optimum system are then discussed. Functional characteristics include provision that frequency assignments be readily available, be serviceable and that the users have available reliable data concerning usage of the same and adjacent frequencies by others. Flexible operations must be facilitated and existing operations protected from interference from newcomers in an equitable way but new systems, when proved, must be accommodated in an orderly manner. Organizational and administrative characteristics of the optimum system include equitable treatment of all users, radio-technical and administrative competence in the personnel involved, a facility for rule-making and for the handling of Government/non-Government and international frequency use coordination and the minimum degree of centralization

of detailed decision making compatible with necessary control. The location of control is discussed in terms of a number of alternatives and it is concluded that it is appropriately located in the Executive Office of the President but that consideration should be given to its relocation into a new Bureau in the Executive Office or transfer to the Bureau of the Budget when relaxation of international tensions permit curtailment or abolition of the functions of the Office of Defense Mobilization where it is now located.

Three major recommendations result from the study. Development of a rule-making procedure is urged to be applicable to management of frequency assignments to Government stations. One application of such a procedure is recommended in order to develop periodically rejustified plans for frequency use during stated intervals during which planned frequency use would enjoy in general, priority in protection from harmful interference as compared with unplanned frequency use. The third recommendation relates to interpretation of the assignment date in the IRAC/FAS records to be simply a key to the coordination record--not, of itself, being in any way indicative of priority right. The detailed record would then be the basis for determination of such rights.

Finally, there are several recommendations for further research. Committee operation techniques should be improved. Consideration needs to be given to further development of Government/non-Government sharing of frequency use and the accommodation of new services in an orderly manner. United States frequency use in foreign countries and its relationship to use in the United States should be studied, as should the application of frequency management experience in the United States to international frequency management.

365 pages. \$4.70. Mic 56-3501

## PSYCHOLOGY

### PSYCHOLOGY, GENERAL

#### THE DEVELOPMENT OF A SELECTION PROCESS FOR AN INSPECTION TASK

(Publication No. 18,828)

Lewis Edwin Albright, Ph.D.  
Purdue University, 1956

Major Professor: C. H. Lawshe

A research problem in industrial psychology which makes a statistical evaluation of the effectiveness of tests used for identifying potentially successful analysts.

The purpose of this study was to develop and validate a battery of psychological tests and biographical data items for use in selecting applicants for training in the profession of seed technology. A job analysis was performed to determine the skills and abilities necessary to perform the job. The results of this analysis indicated that visual skills, manual dexterity, mental ability and preference for sedentary, routine work were all necessary in some degree.

Tests chosen to measure these abilities and preferences were the Ortho-Rater, Purdue Pegboard, the O'Conner Tweezer Dexterity Test, the Adaptability Test, the Purdue Non-Language Adaptability Test and the Purdue Job Preference Survey. Also, a biographical data inventory was devised. The criteria against which the battery was validated were a job sample and paired comparison ratings by supervisors.

Test and criterion data were collected from 103 seed analysts in 20 different laboratories in 13 states. An analysis of variance of job sample scores showed that the laboratories were heterogeneous with regard to their performance on the criterion. Product-moment correlations of the predictors with each criterion yielded four significant validities. The Adaptability Test, the Tweezer Dexterity Test and two Ortho-Rater phoria tests had low, but significant correlations with the ratings criterion.

In addition to heterogeneity among laboratories, other sources of criterion contamination were thought to exist. These were the wide differences in age and job experience of the subjects and the mixture of the sexes in validating tests where sex differences have been found. Two analyses

were performed in an effort to free the criteria of some of this contamination. The first procedure was the ranking of individuals within laboratories on test and criterion variables and the computation of rank order correlations between ranks for each laboratory. These correlations were then averaged across laboratories by means of Fisher's  $z$  transformation and tested for significance. Four of the averaged Rhos were significant; two Purdue Pegboard subtests with the job sample and the Adaptability Test and the Tweezer Dexterity Test with ratings.

The second procedure was that of selecting three groups of subjects with similar amounts of experience and similar job sample scores. For each group, job sample scores were plotted against scores on the ratings and these distributions were dichotomized at their medians. Superior and poor analysts were selected on the basis of their being either above or below both medians. An analysis of variance showed that five Ortho-Rater subtests significantly differentiated superior from poor. A cross-validation of the biographical data inventory with these same criterion groups yielded a biserial correlation of .287; this value was judged too low to warrant use of the blank for selection purposes.

Aside from the sources of criterion contamination already mentioned, evidence was found to suggest that natural or secondary selection factors among employees were operating to depress test validities. The failure of the study to produce more positive results was interpreted in the light of all these sources of error variance. It was recommended that the Adaptability Test, the O'Conner Tweezer Dexterity Test and a visual examination be used in the selection of applicants for training in seed analysis.

98 pages. \$1.50. Mic 56-3502

#### CONSTRUCTION OF A FORCED-CHOICE UNIVERSITY INSTRUCTOR RATING SCALE

(Publication No. 19,291)

Emmoran Benjamin Cobb, Ph.D.  
The University of Tennessee, 1956

A scale for student rating of college teachers was constructed by using product-moment correlations between three hundred and ninety-four items, which had been isolated as relevant to effective teaching through preliminary research, and criterion scales of "liking as a person" and "teaching effectiveness" as indices of biasability and discrimination. The data were obtained by administration of six forms of a Qualification Check List in each of one hundred and twenty-four classes from seventy different colleges in the United States. About six hundred students used each form. Various modifications of forced-choice method were used to construct a one-hundred-and-sixteen item validation scale. This scale was administered in graphic format by nine complete departments in nine different colleges under operational conditions. Because this scale differed from a forced-choice scale only in the instructions to the rater, it was possible to score it as if it were a forced-choice scale and also as a graphic scale. Forced-choice scoring produced high validity against a composite criterion in which teachers were distributed according to higher effectiveness than liking criterion

scale score. Scoring as a graphic scale produced higher validity using either criterion scale separately.

Considerable loss of items was experienced in construction of the validation scale, and still greater loss of items would occur if technical requirements and cross-validation data were used to produce a refined and forced-choice version. When the mean difference between items in each couplet was obtained and correlated against the effectiveness criterion scale, all but eleven of the fifty-eight scoring couplets were significant at the five per cent level. A brief analysis of the status of teacher rating in higher education reaffirmed the need for research in the social psychology of a student rating of college teachers. A review of forced-choice theory, method, and practice led to the conclusion that forced-choice format is unsatisfactory for diagnostic purposes. A number of specific research proposals are presented to clarify issues involved in appraising the effectiveness of forced-choice versus other methods and the efficiency of various techniques of controlling bias. It was concluded that the standard method of forced-choice rating scale construction should be modified and further tested before being applied in routine fashion to the construction of a scale to be used by students in rating college instructors.

202 pages. \$2.65. Mic 56-3503

#### DEVELOPMENT OF TESTS ESPECIALLY DESIGNED FOR THE ADULT AND OLDER YEARS

(Publication No. 18,785)

John Albert Demming, Ph.D.  
The Ohio State University, 1956

Early studies of adult mental abilities indicated that general ability grew to around the age of twenty, and thereafter steadily declined. Older people fell off rapidly on certain subtests, such as rote learning, but held up on others, such as information. And some older persons did very well.

Gradually these early findings came to be somewhat qualified. It was realized that the average older person had had less education than the average younger adult, and was less used to tests. Recent cross-sectional studies with better sampling have a little later peak and a slower decline.

Longitudinal studies have shown average persons continuing to increase in ability at least until twenty-five, and superior individuals scoring on verbal material even past fifty. The cumulative effect of this recent research has been to indicate the need to qualify early conclusions concerning the decline of mental abilities with age and to suggest a broad reappraisal of abilities in the adult years.

Practically all of even the recent research has been with tests of the general type which became standard in the heyday of testing some quarter of a century ago--essentially clerical, formal, academic, meant for use with young people. For the generality of adults and for appraising competency in tasks characteristic of adult life, it would seem desirable to use matter and methods more natural to adult existence, somewhat as tests for children are made for children.

This project attempts to construct and appraise tests thus especially designed for adults and for measuring

competencies needed in adult life. It hypothesized that maturity was distinctively characterized by a wide range of information regarding adult affairs, social perceptiveness, practical judgment, and so on. Since previous studies have shown adults holding up best on tests of information and vocabulary, several such tests were made, as well as tests involving practical judgment. In all, twenty separate objective group tests were put into at least trial form, and seven received more extensive analytical appraisal. The tests were given to considerable numbers of college undergraduates, not alone because they were most available, but because their medians were thought of as reference points above which it was hoped the adult scores would go. The adults tested included students in summer session and evening classes, members of Golden Age and Grandmothers clubs, and current admissions to a penitentiary. For teen-age scores, high school students were tested.

On five of the tests, all the middle-aged adult groups, both civilian and convict, averaged scores higher than the twenty to twenty-four age group selected as the base. Even adults fifty and over tended to do better than the base group. The high school group scored lowest. However, scores available from previous testing at the penitentiary showed middle-aged and older inmates scoring progressively lower with increased age on the Otis intermediate test of general ability, the Army Beta, Minnesota Paper Form-Board, and Bennett Test of Mechanical Comprehension.

Simple tests of the sort here reported might be of value in indicating the extent to which a youth in an orphan asylum, a state hospital patient, or a veterans' administration domiciliary resident had certain practical knowledge and information needful to conduct everyday affairs with ordinary prudence. They could appraise the "maturity" of secondary school pupils' practical information. Such tests might also lead to substantial revision of current concepts regarding abilities in the adult and older years.

95 pages. \$1.50. Mic 56-3504

#### PARENTAL ATTITUDES IN RELATION TO THEIR CHILDREN'S SOCIAL ACCEPTANCE, INTELLECTUAL FUNCTIONING LEVEL AND EMOTIONAL ADJUSTMENT

(Publication No. 19,352)

Caroline Lawther Dowlen, Ph.D.  
University of Houston, 1956

The present study was concerned with an attempt to demonstrate that parental attitudes in terms of a rigidity dimension are related to children's social and emotional adjustment and intellectual functioning level. The three hypotheses specifically tested were: (1) relationship between parental attitudes as measured by the F-Scale and social acceptance of the child as measured by peer sociometric ratings; (2) relationship between intelligence as measured by the Draw-a-Man test and social acceptance; (3) relationship between emotional adjustment as measured by the World Test and social acceptance. Comparisons were also made between the predictor measures or rigidity, intelligence, and emotional adjustment.

The subjects consisted of 297 families who returned completed F-Scales from an original population of 467 families in a public school. One section of each grade for seven grades, ranging from Kindergarten through the sixth grade, was used. There were 223 children in these seven grades.

The sociometric ratings were made in the form of a "Guess Who" game, in which the children chose each other on a series of nineteen "Who is it who - - ?" items describing specific behaviors such as quietness, etc. The other measures, F-Scale, Draw-a-Man test, and the World Test, were administered and scored in the standard way.

Bi-serial correlations were computed between upper and lower sociogram groups and the F-Scale and Draw-a-Man distributions for each grade level. Chi-squares were computed between the upper and lower sociogram groups and upper and lower World Test groups on each of the World Test scoring categories.

The following results were obtained between the criterion measure and the predictor measures:

(1) Significant bi-serial correlations of -.72 at the Kindergarten level, -.51 at the 1st grade level, and -.22 for the total group between the parent's F-Scale and the sociometric ratings.

(2) Significant bi-serial correlations of .54 at the 1st grade level, .45 at the 2nd grade level, .70 at the 6th grade level, and .40 for the total group were obtained between the Draw-a-Man test and the sociometric ratings.

(3) Significant negative relationships, as tested by Chi-squares, were obtained between "Disarranged Worlds", and "Total Number of Symptoms" scoring categories on the World Test and sociometric ratings.

In the comparisons between the different predictor measures, the following results were obtained:

(1) Significant positive relationships as tested by Chi-squares between "Disarranged Worlds", "Aggressive Worlds", and "Total Weighted Scores" categories on the World Test and the F-Scale. There was thus evidence of a relationship between parental rigidity and emotional maladjustment of the child as measured by these scores on the World Test.

(2) There were significant relationships between parental rigidity and social acceptance, particularly evident at the lower grade levels. The relationship between intelligence as measured by the Draw-a-Man test and social acceptance was evident at the higher grade levels as well as the first and second grades. This relationship appeared to show a different pattern when examined at different grade levels as compared to the parental rigidity variable. Finally emotional adjustment appeared to also have some relationship to social acceptance. Although the Draw-a-Man test and the F-Scale showed a relationship to each other, particularly at the lower age levels, only the F-Scale scores were related to emotional adjustment as measured by the World Test.

86 pages. \$1.50. Mic 56-3505

**LEADERSHIP IN RURAL COMMUNITY ACTION:  
A STUDY OF DECISION MAKING**

(Publication No. 17,994)

Charles Maddry Freeman, Ph.D.  
North Carolina State College, 1956

Supervisor: Selz Cabot Mayo

Persons who make major decisions also make minor decisions for community action in one open-country community of North Carolina. Sociometric charts indicate that top lay leaders talk not only with other top and intermediate leaders in decision making; they interact directly with people from the top to the bottom of the leadership structure. This is not always true of professional leaders, however. Some professional leaders work informally through a few selected laymen to influence indirectly the behavior of other residents of the community.

The findings on lay leadership in this community, which is a loose confederation of four neighborhoods, contrast with decision making patterns in bureaucratic structures and urban centers. Other students have found that in complex situations major and minor decisions are generally made at different levels of the leadership structure, and relatively sharp breaks in lines of interaction occur between levels.

In the present study, analysis has been made of 813 decisions which were made in 41 innovations for community action. For each decision, information has been obtained on what was decided, who took part in the decision, and how and why the decision was made.

Major emphasis in the study has been placed on leadership statuses in relation to participation in decision making. Three main summary measures have been devised for analyzing data on leadership statuses and roles:

1. Formal leadership score, based on lists of formal leaders in all organizations of the community.

2. Informal leadership rank, obtained by judges' ratings. In the appendix is presented the method for computing Kendall's tau, which has been used extensively in rank correlation analysis involving informal leadership ranks.

3. Decision making score, computed on the basis of: (a) six items of behavior in decision making and (b) expected cost of executing decisions.

There is general correspondence in most neighborhoods between individuals' different leadership statuses and roles, as shown by correlations between the above three measures. Positive correlations were also found between individuals' leadership statuses and roles and those of their close relatives.

Actions have been divided into stages on the basis of a time element and differentiation between goal and plan. Achievement of the original goal of action is positively related to participation by persons with high formal leadership scores and to participation by professional leaders. Goal achievement also seems to be related to thorough exploration and specific setting of goals and plans before execution of action begins. The two more highly organized neighborhoods of the community, in which a succession of small actions are undertaken, tend to achieve their goals. On the other hand, the two less highly organized neighborhoods, in which few major actions and even fewer small actions occur, tend not to achieve their goals.

Some suggestions are presented for further research

in three areas: (1) the rural community, (2) leadership structures, and (3) decision making for community action. Practical implications of the study are pointed out in the following areas: (1) identification of community leaders, (2) leadership training, and (3) planning community action.

309 pages. \$4.00. Mic 56-3506

**DISCRIMINATION LEARNING AND TRANSPOSITION  
OF LEARNING IN CHILDREN AS A FUNCTION  
OF THE NATURE OF THE REWARD**

(Publication No. 18,671)

Wallace A. Kennedy, Ph.D.  
The Florida State University, 1956

The present experiment was designed to study the effects of different types of rewards upon the learning process of children, using as subjects 96 four- and five-year olds and 96 eight- and nine-year olds, divided into four experimental and two control groups at each age level. Two tasks were required of each subject: (1) to respond nine times out of the last ten trials to the large sized stimulus in each of three pairs of three dimensional stimuli in the shape of cubes, cones, and cylinders, and (2) to transpose this learning to a second problem, which paired an oversized cube with the large sized cube, in four successive trials.

Four criteria of the effectiveness of the rewards studied were obtained. The three criteria used in evaluating task one were: (1) the number of trials necessary to reach the learning criterion, (2) the number of errors made in reaching it, and (3) the per cent of errors out of the total trials. For task two the criterion of effectiveness was the number of responses to the oversized stimulus, i.e., the number of transpositions.

The rewards studied were as follows: (1) praise, which was given verbally in a standard manner after each correct trial, (2) blame, likewise verbal and standard, after each incorrect trial, (3) candy, a white party mint of uniform size, given after each correct response, and (4) a token, a white navy bean of uniform drill, which symbolized one-fiftieth of a bag of candy. The purchasing power of this token was uniformly explained to each subject in this group. In addition, there were two control groups: Control group A, which was given no reward, but was reinforced by a small light flash after each correct response, as were all other groups except control group B; and control group B, which received no reward, but was randomly reinforced by the light flash regardless of response made.

The evidence indicates that for all criteria of success the candy reward group was significantly superior.

44 pages. \$1.50. Mic 56-3507

**PERCEPTUAL ABILITY AND SCHOOL  
ACHIEVEMENT: AN EXPLORATORY STUDY**  
(Publication No. 18,859)  
Robert Glenn Lowder, Ph.D.  
Purdue University, 1956

Major Professor: N. C. Kephart

A research problem which explores the relationship between perception and school achievement.

Previous studies have indicated a relationship between perception and reading skill, and between reading skill and school achievement. A relationship between outline form perception and school achievement in the lower grades was hypothesized.

Copying of simple geometric forms was used as a measure of outline form perception. Teachers' evaluations were used as a criterion of school achievement.

Every pupil (N=1510) in the first three grades of the Winter Haven, Florida public school system copied the seven geometric figures: circle, cross, square, triangle, divided rectangle, horizontal diamond, and vertical diamond. The adequacy of their copies was evaluated by expert judges. The score assigned to total copying performance was correlated with school achievement.

A correlation of about .50 was found between copying performance and school achievement. The reliability of performance was about .70. Reliability of raters was above .98. The cross and square were poor discriminators. The divided rectangle and horizontal diamond were the best discriminators and also the most difficult items.

68 pages. \$1.50. Mic 56-3508

**MANIFEST ANXIETY, SHOCK, AND STIMULUS-  
RESPONSE CONDITION AS DETERMINANTS OF  
PERFORMANCE ON A VERBAL LEARNING TASK**

(Publication No. 18,808)

Winifred Barbara Brown Maher, Ph.D.  
The Ohio State University, 1956

It has been demonstrated that anxiety facilitates performance in simple, and impairs it in complex, learning situations. It is hypothesized that anxiety functions as drive, and as such facilitates non-selectively any response tendencies present. The effect of anxiety would be, therefore, a function of the number and strength of incorrect, relative to correct, response tendencies characteristic of the learning situation. An alternative, or supplementary, explanation is that anxiety-associated responses interfere with efficient learning of complex tasks.

A transfer learning situation was utilized to investigate this problem. The experimental task was held constant, and number and strength of task-associated incorrect response tendencies were varied by systematic alteration of previous learning experience. Two groups of subjects, low anxious (LA) and high anxious (HA), were selected on the basis of extreme Taylor Manifest Anxiety Scale scores. Training to one errorless repetition on an original list of twelve paired adjectives was followed by practice to two successive errorless repetitions of a transfer list of

twelve paired adjectives—four of which were S2R1, four S2R2, and four S1R2 in relation to corresponding pairs on the original list. Five re-learning trials on the original list were given immediately following transfer learning. Shock (S) was administered to half of each group for failure to respond correctly during transfer learning.

No differences were obtained between groups for performance on the original list.

As predicted, scores on the transfer task were found to be in part a function of S-R condition irrespective of anxiety/shock. All groups performed consistently better on S2R2 than on S1R2 items; these differences attained statistical significance in the LA and HA groups. Performance on S2R1 items was inferior to performance on S2R2 items (statistically significant for the HA group), and did not differ significantly from performance on S1R2 items. These results indicate that the learning paradigm A-B: C-B does not necessarily yield positive transfer effect, and support the assumption that positive transfer effect with dissimilar stimuli is a function of inter-list response similarity only when previously established response differentiation is relevant to the transfer task. It is also suggested that each R1 is integrated with the complex of R1's during original learning, and therefore may elicit inappropriate R1's which interfere with performance during transfer learning.

Performance on the transfer list by the LA group was significantly superior to that of the three remaining groups; the HA group performed consistently better than the LA-S and HA-S groups (although statistical significance was attained only in the case of the LA-S group). The close similarity in performance of the LA-S and HA-S groups was attributed to decrease in effect of additional drive as high levels of drive are reached.

Results of the analysis by S-R condition support the conclusion that impairment of performance of anxious subjects on a complex transfer task is a function of number/strength of task-associated erroneous responses. Impairment of performance of the shock groups was attributed to stress-generated competing responses since performance of these groups was consistently inferior to that of the LA group irrespective of S-R condition.

S2R2 items of the original list were relearned most readily, S1R2 items least readily. The LA-ex S group performed significantly more poorly than the three remaining groups on the re-learning trials; this poorer recovery of LA, as compared with HA, subjects from effects of objective stress was tentatively interpreted in terms of adaptation of HA individuals to the presence of irrelevant anxiety-associated responses.

117 pages. \$1.50. Mic 56-3509

**THE RELATIONSHIP BETWEEN THE LEVEL OF ASPIRATION AND SOME GROUP AND INDIVIDUAL VARIABLES**

(Publication No. 18,863)

Angel Rubin Mora, Ph.D.  
Purdue University, 1956

Major Professor: N. M. Downie

The primary purpose of this study was to investigate the extent to which certain variables (e.g., achievement, sex, size of high school graduating class, occupation of the parents, and religion) are related to levels of aspiration. The relationship between predictions made with a varying amount of reality orientation was also investigated.

For this purpose a population of 466 Purdue University students was requested to predict their individual levels of performance in three introductory psychology departmental course examinations (Appendix A). Three groups, 1) over-estimators, 2) medium-estimators, and 3) under-estimators were selected on the basis of their attainment discrepancy scores. Our sample consisted of 150 students. The variables mentioned above were collected from either the students themselves or University records.

The relationship between the level of aspiration and all of our achievement variables (e.g., English and Mathematics Purdue orientation scores; college cumulative grade index, rank in high school graduating class, and final grade in the course) were found to be negative. These correlations ranged from -.29 for the Mathematics test to -.75 for final grade in the course in which the level of aspiration was measured.

Significant differences between the sexes were found in the study. Though previous studies point towards some differences between the sexes in levels of aspiration, the extent of this difference in a college population was not anticipated. As in almost all previous research in this area, individual differences in levels of aspiration were pronounced. An explanation of this large degree of variance between one individual who "hitches his wagon to a star" and hopes for the unattainable and another who is satisfied or elated with a below average or mediocre performance was explored.

The occupation of the parents, size of high school graduating class, and religious preference were not found to differ significantly among our level of aspiration groups, except in the case of Lutherans and Roman Catholics. Here a difference significant at the .01 level of confidence was found.

The relationship between reality and unreality scores was also investigated. Though a fairly high correlation was found, there is some reason to include both in a total measure of the level of aspiration. Adjustments or shifts made in a goal-setting situation due to reality factors as well as those adjustments made in response to 'inner needs' should be part of such a heterogeneous trait.

75 pages. \$1.50. Mic 56-3510

**PERSISTENCY OF ATTITUDES TOWARD VOCATIONAL COUNSELING**

(Publication No. 19,281)

Ralph Ayres Schofield, Ed.D.  
Indiana University, 1956

Chairman: Louis G. Schmidt

This study was designed to determine the persistency of attitudes toward Veterans Administration vocational counseling. Organization of the data led to the refinement of the problem to include information regarding the occupational adjustment of the veterans since 1951; also to an inquiry into the consistency of reasons given by veterans for their having discontinued training or for their having entered a type of work unrelated to their training objective; and further to a discovery of the chances that a veteran would re-enter and complete training once training was discontinued.

The design of the study utilized responses to questionnaires that were administered in 1951 and 1956 to the same group of veterans. The major types of information obtained from the questionnaire were identifying characteristics; reasons for having discontinued training or accepting employment in a field of work not related to the vocational training that had been provided by the Veterans Administration; employment activity since 1951; and, expressions of attitude toward counseling through responses to seven specific questions. The subjects were 357 veterans who were classified as seriously disabled in 1951, and who were among 452 seriously disabled veterans previously studied. The veterans had received vocational counseling and had completed or discontinued their vocational rehabilitation between 1946 and 1950. Several methods of statistical analyses were applied to the data collected and those made available from 1951.

An analysis of the data revealed certain findings and conclusions:

1. There was a relationship, significant at the 1 per cent level, between the attitudes expressed by the individual veterans in 1951 and 1956.
2. For the combined groups of veterans there was no significant difference between the mean attitude score in 1951 and 1956.
3. Since 1951, 55 per cent of the veterans in the rehabilitated group remained on the same job, whereas only 31.8 per cent of the veterans in the discontinued group remained in the same job for the five-year interval.
4. While only 2.1 per cent of the veterans of the rehabilitated group reported college graduation as the highest level of educational achievement in 1951, 26.3 per cent reported this level in 1956. This represented the only major shift discovered in educational level for either group.
5. In 1951, 114 veterans who had discontinued training felt reasonably sure that they would re-enter a program of training; but only 6 veterans, or 5.3 per cent, had re-entered training and completed it since 1951.
6. Sixty per cent of all the veterans reported that they felt a need for additional counseling opportunities since 1951.
7. Reasons given for discontinuing training or for changing to a job unrelated to one for which they were trained remained quite consistent from 1951 to 1956.

The findings of the investigation show rather conclusively:

1. The hypothesis, that attitudes held by seriously disabled veterans concerning specific and general values of the Veterans Administration vocational counseling are more favorable five years or more subsequent to the counseling experience than they were when ascertained shortly after the counseling experience, could not be sustained on the evidence obtained from the data analyzed.
2. The results of the survey as reported in 1951, appeared to reflect accurately the attitudes of the veterans and their evaluation of the effectiveness of vocational counseling and training.
3. Reasons given by veterans for discontinuing programs of training consistently involved further aggravation of the veterans' disabilities, dissatisfaction with the training, and acute personal and domestic problems.
4. Consistency in the reasons given by rehabilitated veterans for changing to a type of work unrelated to that for which they were trained was not pronounced.
5. Once a veteran discontinued a program of vocational training, his chances were not favorable for re-entering training. They were even less favorable for his re-entering and completing a program for vocational rehabilitation.
6. Employment status of the groups remained relatively unaffected by the five-year interval.
7. Veterans in the discontinued group reported slightly more dissatisfaction with their present employment situation than did those veterans in the rehabilitated group.
8. Veterans who were rehabilitated reflected more stability in vocational adjustment, considering the number of jobs held during the five-year interval; they tended to remain in employment for which training had been provided.
9. College graduation appeared as an important single factor in the change in educational achievement for veterans who were in the rehabilitated group.
10. Continued need for opportunities for vocational counseling was expressed by over 50 per cent of the veterans, regardless of their status.

160 pages. \$2.10. Mic 56-3511

**THE VALIDITY OF PEER RATINGS AS A FUNCTION  
OF RATER CHARACTERISTICS AND METHODS  
OF SCORING**

(Publication No. 18,826)

Leroy Wolins, Ph.D.  
The Ohio State University, 1956

The study is based on 974 enlisted men in gunnery school. The peer ratings were made during the seventh week of training. Each member of a barracks selected three men and rejected three men living in the same barracks with him. He did this twice. The first time, he was instructed to rate the men according to his expectations of the quality of their performance in the front lines, working and living with the rater. The second time, he was to rate them according to his expectations of their performance as gunners, working and living away from the rater, who was still on the fighting front--depending on them to fire shells over him into enemy territory.

In order to determine whether acceptances and rejections should be combined and, if so, how to combine them, they were scored separately. In addition to the four variables (two acceptances and two rejections), 15 measures of intelligence and performance were available for each person.

These 19 variables were intercorrelated and, in addition, the scores of the raters were correlated with the scores of the men they selected and rejected. This 19 by 95 matrix of correlation was factor-analyzed.

It is concluded that an individual's ability to rate appropriately is dependent on general intelligence more than on anything else. Raters high on performance measures, physical fitness, reaction time, verbal ability, etc., rate inappropriately because they tend to select or reject persons high on certain factors.

Those who perform well on paper-and-pencil tests of general intelligence tend to select persons who are intelligent, but they do not reject those who are unintelligent. Persons who are well accepted or not rejected by their peers are intelligent, and tend to select the intelligent and reject the unintelligent. Those rated high by the sergeants also are intelligent, and tend to accept intelligent persons and reject unintelligent.

The reliability of the peer ratings, as indicated by the communality, is almost .90, but this includes the specific factors--one for the acceptances and one for the rejections. It is conjectured that a more realistic estimate of the reliability of the peer rating is 40-45. The reason for this is that there is evidence indicating that the specifics occur only because the same raters are rating the same persons both times; when the two peer ratings were scored, it was noted that raters frequently selected and rejected the same persons each time they rated.

The communality of the variables describing the rater's behavior indicates that little of the variability among raters is explained by the test variables. It is suggested that measures of personality and morale or motivation might be other factors accounting for rater behavior.

In regard to methods of scoring, it was concluded that the use of net acceptances (i.e., acceptances minus rejections) is a good method of scoring peer ratings. This method tends to maximize the variability of the interpersonal factor--considered to be the most important aspect of the construct validity of peer ratings--and to minimize the variability of false bases for rating (i.e., cases in which persons high on a factor are both accepted and rejected frequently) by allowing the rejections to act as a suppressor variable. 81 pages. \$1.50. Mic 56-3512

## PSYCHOLOGY, CLINICAL

ANXIETY IN PRESCHOOL CHILDREN AND ITS  
RELATIONSHIP TO SOME ASPECTS OF  
THE HOME ENVIRONMENT

(Publication No. 18,776)

Margaret Katherine Body, Ph.D.  
The Ohio State University, 1956

The purpose of the study under discussion was to investigate the influence of the broken home on the anxiety test scores of preschool children and on their home situations. The anxiety test, consisting of fourteen pictures of situations common to the experiences of preschool children, is scored in terms of the number of times the subject selects an unhappy face for the central child figure in each picture. Data on the home situation were obtained from interviews with the parents of the subjects. The sample consists of twenty-two children, eleven from broken homes and eleven from complete or non-broken homes. The complete-home group was used as a control. Each child from the broken-home group was matched by pairing him with a child of equivalent chronological age and intelligence quotient from the complete-home group. Anxiety test data were analyzed by analysis of variance for matched groups. The interview data were analyzed by the use of *t*-tests of the difference between the means of the two groups for ten home variables covered by the interview. Scores for the interview were obtained from ratings made by two judges.

The analysis of variance for the anxiety test results showed significant differences between the broken-home group and the complete-home group on two of the three part scores and on the total anxiety test. This indicates that the children from broken homes have significantly higher anxiety test scores than do the children from complete homes.

There were no significant differences between the two groups with respect to the home environment, as revealed by the *t*-tests.

The findings suggest that the preschool child from a broken home is more likely to have adjustment difficulties than the child from a home with both parents. At the same time the overt situation in the homes of both groups of subjects indicates that few of the twenty-two subjects were free of negative child-rearing practices and home conditions. The significant differences between groups were in the attitudes underlying the child-rearing practices. The adjustment problems of the divorced mothers seemed to be expressed in the following characteristics:

1. Insecurity.
2. Unwillingness to accept responsibility of the child.
3. Rejection and resentment of the child.

There is a need for longitudinal studies of children of divorced parents. It would also be valuable to know more about the child's concepts of the roles of the mother and the father.

97 pages. \$1.50. Mic 56-3513

THE INTERRELATIONSHIPS BETWEEN TWO  
PERSONALITY INVENTORIES AND OTHER  
BEHAVIORAL MEASURES

(Publication No. 19,357)

Norman Charles Bourestom, Jr., Ph.D.  
University of Houston, 1956

The purpose of this study was (a) to investigate the relationships between the Edwards Personal Preference Schedule (PPS) and the Sheer Self-Concept Test (SSCT), both of which served as criteria instruments, (b) to compare the relationships between the PPS variables and other measures of behavior and (c) to compare the relationships between the SSCT factors and other measures of behavior. The other measures of behavior were the Thurstone Interest Schedule, F-Scale, Allport-Vernon Study of Values, Wonderlic Personnel Test, Gottschaldt Embedded Figures Task, McClelland's Achievement Motive, Thematic Apperception Test and a Psychosomatic Inventory.

The investigation consisted of two separate testing stages. In the first phase, the Gottschaldt and Achievement Motive instruments were administered to 150 undergraduate students in psychology at the University of Houston, Houston, Texas. Sixty students (30 males and 30 females) were selected for the second phase of the investigation, which involved the administration of the rest of the tests.

Corrected phi-coefficients of correlation were computed for all variables to obtain estimates of their relationships. Statistical analysis of the data revealed marked differences between the male and female groups on the criteria tests. This result necessitated separate analyses for each group and was consistent with the results reported by the authors of the tests. Possible explanations for these differences were given.

The results of the study demonstrated a number of significant relationships between the two criteria measures. It was also shown that each criterion test was in many ways significantly related to interests, attitudes and values, abilities, projective measures and neuroticism.

From these findings, it was concluded that the Edwards Personal Preference Schedule and the Sheer Self-Concept Test bear certain distinctive relationships to each other as well as to measures of interests, attitudes and values, abilities, projective measures and neuroticism. The most parsimonious descriptions of these relationships seem to be in terms of the six factors in the Sheer Self-Concept Test which include various clusters of the Edwards Personal Preference Schedule, the Guilford-Martin Personality Inventory and the Guilford-Zimmerman Temperament Survey.

118 pages. \$1.50. Mic 56-3514

DIFFERENTIATING CHARACTERISTICS  
OF SUPERIOR OLD PEOPLE

(Publication No. 18,777)

Homer Leslie Bradshaw, Ph.D.  
The Ohio State University, 1956

Statement of the Problem: Because of the insistent needs of the aged, studies of the old have dealt most commonly

with those ill, indigent, or having other problems. In contrast, this research concerns those who in old age seem well-adjusted, happy, useful, and well-liked, and seeks the most significant characteristics and circumstances making them thus superior.

Procedure: The effort has been to study very broadly and over a period of five years a group of two hundred old people in a Midwest urban area who were highly regarded by their associates and about whom a variety of information could be obtained. Selection was made by informal nomination of several people who knew them well. Interviewing and data-gathering were done by a variety of investigators — four graduate students specializing in the study of aging and three able older persons widely acquainted in the community, highly regarded, and much interested. The cases were seen at various times, in various places, and in a variety of situations. They were told that this was a study of superior old people which sought to find ways of making old age better.

Results: Various gross factors such as chronological age, marital status, living arrangements, education, financial status, former occupations, and present health appeared not to be of crucial importance. Even severely handicapped oldsters were found sturdily independent and cheerful. No one set of personal traits or environmental factors was found which could account for the superiority of these cases. There seemed to be a variety of ways of making the later years happy and fruitful. The mere presence of certain favoring situations does not insure successful adjustment, nor lack of them prevent it. The individual personality is the major determining factor, and different personalities work out their adjustments to aging in various ways.

However, certain patterns of personality and certain situations seemed to emerge as especially significant. One of the major characteristics of the group was an outgoing philosophy of life, looking forward rather than backward, and including realistic appraisals of age, flexibility in adjusting to restrictions of old age, willingness to try new things, and tolerance and open-mindedness. Second, the happy oldster was useful in some capacity in his later years, either in remunerative work or in unpaid service. A third factor was continuance of social contacts and membership in social groups. A fourth characteristic was maintenance of active interests in later maturity. A final trait was intellectual curiosity and the desire to learn. A comparison of the best and the poorest cases in a total of two hundred thirty emphasized these findings.

Recommendations: Older people should be practically informed about age. Classes on later maturity and material on aging should be more available. Retirement at an arbitrary age should be discontinued; rather, opportunities should be open to older individuals to continue in earlier positions (perhaps somewhat adjusted in hours or nature to their aging) or find new work, so long as they are able to continue earning and desire to do so. Potentialities of older workers, and adaptations for them which recent research indicates, should be regularly taken account of in personnel practice. Worth-while service programs ought to be encouraged, and could range from such activities as repairing toys for an orphanage to taking leadership roles in community volunteer work; the able old may well prove

a great and largely undeveloped community resource. Clubs should be organized especially to meet their needs and interests. Society in general needs to be given a positive, constructive point of view toward the aged, and to be warned against the commonly held negative stereotypes about age.

112 pages. \$1.50. Mic 56-3515

#### IMAGINATIVE BEHAVIOR OF YOUNG CHILDREN AS REVEALED IN THEIR LANGUAGE<sup>1</sup>

(Publication No. 19,234)

Marguerite Peterson Burnham, Ph.D.  
Columbia University, 1956

This is a study of the imaginative behavior of young children as revealed by verbatim records of their language. Records were taken in the normal nursery school environment by a specially trained stenographer who followed each child for three mornings recording everything he said. Subjects were 80 New York City children 22 to 62 months of age with two records on each of 20 children, giving a total of 100 cases. Most children came from homes above average in socio-economic status; mean IQ of the group was 129.

Study of the records included: (1) a qualitative analysis of certain aspects of the imaginative language; (2) analysis of the content of the language in terms of its subject matter or theme and in terms of certain categories indicating patterns of make-believe; and (3) determination of the amount and proportion of imaginative language, using the remark as the basic unit for analysis.

Among persons working independently in counting remarks and in selecting and categorizing imaginative remarks, agreements ranged from 99.5 to 85 per cent. The Spearman-Brown coefficient of internal consistency for first day scores with second day scores for per cent imaginative remarks is .88.

Illustrative material is presented in the forms of behavior protocols.

#### Findings and Conclusions

##### Themes and Patterns in the Imaginative Language

Forty-two per cent of all imaginative remarks related to domestic life; 29% related to transportation and travel, 16% to animals. Distribution of imaginative remarks among the categories: Assuming or Assigning of a Role, 20%; Ascribing of Life or Human Qualities, 8%; Construction, 5%; Designation, 16%; Transformation, 36%; Other Imaginative Elements, 15%. No significant sex differences were found. Incidents for youngest children were fragmentary and of simple character; complexity and elaboration of theme increased rapidly with age.

##### Imaginative Behavior as Related to Intellectual Development and Social Behavior

Imaginative play was viewed as a creative process in which materials of experience were recombined and reorganized, with realistic details and bizarre incongruities side by side.

The records revealed no evidence of imaginary companions and "fantastic fictionizing" was relatively

infrequent. Certain usages commonly accepted as imaginative seem rather to be speech stereotypes.

Imaginative play was seen as the medium through which in large part children worked out their social adjustments. Much of the imaginative language was self-centered and a motif of seeking status or control was prominent.

Teachers participated in relatively few imaginative situations.

#### Amount of Imaginative Language and Its Relationship to Other Variables

Amount of talking and both amount and proportion of imaginative language tended to increase with age. No significant sex differences were found.

There were some evidences of a positive relationship between intellectual status and imaginative language scores, and probably in a less highly selected group the relationship would be increased.

Individuals varied widely in amount of talking and in both amount and proportion of imaginative language. Talkative children tended also to use a high proportion of imaginative language.

Comparison with findings of other investigators who studied some of the same children suggests that imaginative behavior is part of the very fibre of social behavior.

#### Imaginative Behavior and Personality Development

Imaginative play may be viewed as part of the dynamic process by which the child makes the culture a part of himself. It provides opportunities for learning and serves as a medium for emotional expression. Imaginative language provides important clues to development and adjustment but to understand the significance of these clues in the life of a given child they should be studied in relation to his whole developing personality.

Questions were raised concerning the development, functions, meaning and guidance of imaginative behavior.

142 pages. \$1.90. Mic 56-3516.

1. This study was written in 1940.

#### THE RELATIONSHIP BETWEEN EEG ABNORMALITY, PSYCHOLOGICAL FACTORS AND DELINQUENT BEHAVIOR

(Publication No. 18,366)

Arthur Lee Foster, Ph.D.  
University of Houston, 1956

The present study is concerned with a delineation of some of the differences in psychological functioning between a group of delinquent boys having "Normal" EEG's and a group of delinquent boys having "Abnormal" EEG's.

The sample group consisted of 50 boys obtained from a juvenile detention home in Dallas, Texas. All of the boys were repeated offenders on serious counts. Interviews with each boy and other members of the family, as well as a careful perusal of his written history, were used to detect possible organic involvement. No boy was included in the study whose history indicated the presence of an organic dysfunction.

An EEG was administered to each boy by a trained

technician. On the basis of the interpretation of the EEG by trained specialists, the subjects were divided into two groups; those with a "normal" EEG were placed in one group and those with an "abnormal" EEG were placed in another.

A battery of psychological tests was administered to each subject and scored before the results of the EEG were available. The tests used were the following: (a) The Kinesthetic Figural After-Effect Test to obtain a measure of brain function; (b) Rosenzweig Picture-Frustration Study, Children's Form, to obtain a measure of reaction to frustration; (c) Bender-Gestalt Test; and (d) The Rorschach Test. The two groups were also matched on age and Wechsler-Bellevue Intelligence scores.

The measures obtained on the Kinesthetic After-Effect test were first converted into a percentage decrease using the initial measurements as a baseline. From this, a percentage of decrement was calculated which bore a direct relationship to the degree of figural after-effect. Comparisons between the medians of the "Normal" and "Abnormal" EEG groups on this measure were made at the several testing points.

Similar comparisons between the medians of each of the delinquent groups were made on distributions of scores from the Rosenzweig Picture-Frustration Study and the Rorschach test. Scores on the Rosenzweig and on the Bender from each of the groups were also compared with Normative data.

Statistical analysis applied to these comparisons yielded the following results:

1. On the Kinesthetic After-Effect test the "Normal" EEG group consistently had a higher percentage of decrement than did the "Abnormal" EEG group at the several testing points. Although none of the differences were statistically significant, they were consistently in the same direction. In accordance with Wertheimer's theory, this would indicate a lowered level of metabolic efficiency in the members of the "Abnormal" EEG group.

2. On the Bender-Gestalt test both of the delinquent groups were different from the Normative data but not different from standardization data on psychoneurotic groups. No differences between the two delinquent groups were found on this measure.

3. On an over-all measure of group conformity on the Rosenzweig Picture-Frustration Study both delinquent groups differed from the Normative group. They gave fewer "popular" responses to the test than did the Normative group. On the Direction of Aggression scores the "Normal" EEG group gave more Extrapunitive responses than did the "Abnormal" EEG group. Both delinquent groups gave fewer Intropunitive and more Impunitive scores than the Normative group with which they were compared.

On the Super-Ego Pattern scores the "Normal" EEG group gave more responses which directed aggression and hostility overtly onto things or persons in their environment than did the "Abnormal" EEG group. They also gave more responses which expressed acceptance of guilt or shame. The "Abnormal" group gave more responses which "excused" or denied the blame or responsibility for some behavior with which they were charged. Both delinquent groups gave fewer responses which denied blame or "excused" themselves from blame than did the Normative group. The "Normal" EEG group also tended to give more responses directing hostility or aggression outward and

also more which expressed acceptance of guilt or shame than did the Normative group. However, the differences on these latter two measures were not significant.

No differences on the Type of Reaction scores were found between the two delinquent groups. When compared with normative data the "Normal" EEG group gave more responses which were ego-defensive and fewer responses which were need-persistent. The "Abnormal" EEG group did not differ from the normative data on any of these measures.

An over-all examination of the results of the Rosenzweig reveals that the "Abnormal" EEG group tended to give the same or approximately the same scores as the Normative group more often than the "Normal" EEG group. This indicates that on this measure the "Abnormal" group was more like the Normative group than was the "Normal" group.

4. On the Rorschach test the "Normal" EEG group displayed more paranoid behaviors and attitudes than did the "Abnormal" EEG group. The latter group showed a trend, which was not statistically significant, to be more anxious in their test behaviors and attitudes.

The results of this study suggest that delinquents may be classified into subgroups on the basis of specific factors associated with each subgroup. In terms of personality and causation we may be dealing with several different kinds of delinquents, each kind being determined by a different constellation of factors. On the basis of EEG findings a sample of delinquents has been subgrouped into two categories and personality differences found.

91 pages. \$1.50. Mic 56-3517

critical responses, the acquisition asymptotes, or the acquisition rates. These findings, particularly the absence of differences at acquisition asymptote, corroborate the general findings of previous studies which report little difference in the acquisition performance of partial and continuous reinforcement groups.

2. During acquisition, the pronoun class variable showed no significant effect on the number of critical responses, acquisition asymptotes, or acquisition rates.

3. During acquisition there was a significant pronoun class x reinforcement schedule interaction for the acquisition asymptote measure.

4. During extinction, the reinforcement schedule variable showed no significant effect on the number of critical responses, extinction asymptotes, or extinction rates. Since there was a significant difference in the number of reinforcements given to the groups during acquisition, the number of reinforcements was statistically controlled by analysis of covariance. When this was done, the reinforcement schedule variable showed a significant effect on the number of critical responses and the extinction asymptotes.

5. During extinction, the pronoun class variable showed a significant effect on the number of critical responses and the extinction asymptotes. When the number of reinforcements was statistically controlled, this variable showed no significant effect on any response measure.

6. During extinction, there was a significant pronoun class x reinforcement schedule interaction for number of critical responses. When the number of reinforcements was statistically controlled, this variable showed no significant effect on any response measure.

7. Subjects within each group whom the experimenter judged to have correctly verbalized the pronoun-reinforcement contingency were compared with subjects who did not verbalize this connection. The results indicated that awareness of this contingency had a significant effect only in the continuously reinforced groups.

In this experiment partial reinforcement groups did not demonstrate a greater resistance to extinction than the continuous reinforcement groups without a statistical control for the number of reinforcements. Since this finding is at variance with most of those of previous related studies, the extinction findings are discussed in terms of the extent of the extinction process when comparisons are made. This point is important in that none of the groups showed significant decreases in the frequency of responding. Sources of reinforcement inherent in the reinforcement procedure employed, and the limitation of response alternatives may have maintained the high frequency of responding. 81 pages. \$1.50. Mic 56-3518

#### THE EFFECT OF REINFORCEMENT SCHEDULE AND RESPONSE CLASS ON VERBAL CONDITIONING

(Publication No. 17,954)

John M. Grossberg, Ph.D.  
Indiana University, 1956

This experiment used a sentence construction procedure to investigate the effects of two variables on verbal conditioning. These variables were response class and reinforcement schedule. Subjects were presented with cards one at a time. Each card listed a past tense verb and six pronouns. Subjects were told to construct sentences beginning with a pronoun and including the verb. The experimenter used "good" as a reinforcement. The pronouns I and WE constituted one response class, the pronouns HE and SHE constituted the other. The reinforcement schedules employed were 0%, 50%, 75%, and 100%. Subjects were 120 undergraduates who were randomly assigned to eight groups, two groups for each reinforcement schedule. The pronouns I and We were reinforced for one of these two groups, the pronouns HE and SHE for the other. Following 120 acquisition trials, 160 extinction trials were administered.

The main response measures were the number of critical responses, asymptotic critical response frequency, and rate of change in critical response frequency. The principal results were:

1. During acquisition, the reinforcement schedule variable showed no significant effect on the number of

**A COMPARATIVE STUDY OF CERTAIN PERSONALITY CHARACTERISTICS OF PSYCHOPATHIC AND NON-PSYCHOPATHIC OFFENDERS IN A MILITARY DISCIPLINARY BARRACKS: WITH REFERENCE TO THE PERSONALITY CHARACTERISTICS OF IMMURITY, IMPULSIVITY, HOSTILITY, AVOIDANCE, SUPERFICIALITY, SHALLOWNESS, ANXIETY, GUILT, EGOCENTRICITY, AND FACILITY IN PERFORMANCE TASKS**

(Publication No. 17,655)

Leonard Kingsley, Ph.D.  
New York University, 1956

Chairman: Professor Brian E. Tomlinson

The purpose of this study was to evaluate and to compare certain personality characteristics of twenty adult, male psychopathic and twenty non-psychopathic prisoners within a military disciplinary barracks.

It was hypothesized that the members of the psychopathic group would be characterized by egocentricity, hostility, impulsivity, immaturity, avoidance and superficiality; that they would be incapacitated in their interpersonal relations; that they would exhibit a shallowness in their fantasy lives together with an absence of anxiety and guilt; and that their skill and facility in manual and performance tasks would exceed their verbal abilities.

It was further hypothesized that those characteristics of the psychopathic group would significantly differentiate them from non-psychopathic members of a prison population.

The research populations consisted of twenty psychopathic military offenders diagnosed by army psychiatrists as Antisocial Personalities or Asocial Personalities and a group of twenty non-psychopathic military offenders. The two populations were equated for: chronological age, educational level, length of military service, length of military sentence, time served at time of testing, level of intelligence, marital status, race and religion.

The Wechsler-Bellevue, Rorschach, MMPI and Sacks Sentence Completion tests were administered to all subjects and results of tests treated to determine the presence or absence of characteristics indicated under the hypothesis stated above.

The psychopaths were found to possess the characteristics of shallowness, egocentricity, avoidance, immaturity, impulsivity, hostility, anxiety and guilt feelings. The psychopaths were likewise underproductive, lacked freedom and originality in their thinking, tended to see the obvious and lacked the personal capacities to make their drives realistic.

Avoidance, anxiety, and guilt feelings were also found to be characteristic of the non-psychopathic group. The non-psychopaths were slightly underproductive, lacked originality and demonstrated a tendency toward a constriction of expression.

A comparison of the test results of the two groups was made. Following a median separation of the distribution of scores of the groups the chi-square formula was used to test the significance of the difference between the upper and lower halves of both distributions. The number of psychopaths indicating the presence of shallowness, egocentricity, immaturity, impulsivity, hostility and emotional disturbance in attitudes toward authority figures and toward

heterosexual relationships differed significantly from the number of non-psychopaths indicating these characteristics. The significance of these differences varied from the one to five per cent level of confidence. There were no significant differences between the two groups as far as degree of anxiety, guilt feelings, superficiality, avoidance, or facility in performance tasks was concerned.

A qualitative analysis of the anxiety responses of the two groups revealed that the psychopaths were concerned with committing, or having committed an aggressive act and with fears of impersonal objects, events and threatening animals. The non-psychopaths were concerned with their own reactions to anxiety and with the attitudes and feelings of other persons toward them. The psychopaths also indicated a significantly lesser degree of conformity to group thinking and a significantly greater loss of emotional control than did the non-psychopaths. Personality trends present in the psychopaths, but not to a significant degree, were those of heightened emotional responsiveness, greater originality, greater rejections of stimuli, and a lesser depth of creative resources.

It was concluded that a constellation of personality characteristics comprising immaturity, impulsivity, hostility, egocentricity, shallowness, incapacity in interpersonal relations with authority figures and in heterosexual relations differentiated the psychopaths from the non-psychopaths. It was also concluded that the psychopaths met Karpman's criteria for the Symptomatic Psychopaths more nearly than his criteria for the Idiopathic category. The presence of anxiety and guilt feelings in the psychopathic group especially contributed toward the classification of these individuals in the Symptomatic category.

182 pages. \$2.40. Mic 56-3519

**VARIABLES INFLUENCING THE GENERALIZATION OF EXPECTANCY STATEMENTS**

(Publication No. 18,811)

Walter Mischel, Ph.D.  
The Ohio State University, 1956

The present research attempted a methodological investigation of some of the variables influencing the generalization of verbal goal-setting behavior. The verbal measures used were the operational referents for the expectancy and minimal goal level constructs within Rotter's social learning theory.

One phase of the investigation dealt with the effect of two disparities on the generalization of expectancy and minimal goal statements. These were the disparity between the obtained reinforcement and the stated expectancy (E-R) and the disparity between obtained reinforcement and the stated minimal goal level (MG-R). Reinforcement and all estimates were in the form of "scores" in a series of graded scores. The attempt was to test the effect of each disparity, with the other controlled, on the generalization of estimates.

The second major phase of the research was concerned with the effect on generalization of the "commitment" aspect of the psychological situation under which testing takes place. "Commitment" here refers to the subject's tendency to maintain his original estimates on a given task

in the face of obtained "failure" on a related task. Variations in the testing situation and in the explicitness with which original estimates are made were formulated to test commitment effects.

The outlines of the experimental procedure are as follows. Male and female college subjects were employed in a modified level of aspiration design. Expectancy and minimal goal estimates were obtained for two tasks prior to performance on either. Following performance and reinforcement on the first task, subjects were given the opportunity to change their estimates for the second task. The amount of change in estimates for the second task was used as the main measure of generalization.

The design varied both the reinforcement obtained and the psychological situation under which testing took place. Variation in reinforcement patterns provided groups varying in the size of the disparity between obtained reinforcement and stated expectancy for Task One (E-R), with the disparity between obtained reinforcement and minimal goal statement (MG-R) controlled, and vice versa. Situational (commitment) effects were tested by comparisons of various group and individual testing situations, all under the same condition of reinforcement. Two groups, structured to differ in terms of the "explicitness" of initial estimates, were also employed.

In brief, the following were the major tentative conclusions drawn from the obtained results:

1. There is a more or less direct relationship between the size of the E-R disparity and the amount of generalization of expectancy statements. There is no significant relationship between this disparity and changes in minimal goal statements on a related task.

2. There is some relationship between the MG-R disparity and the generalization of expectancy statements. However, the significance and direction of the effect of this disparity remain inconclusive. The effect of the MG-R disparity on changes in expectancy statements is markedly less than that of the E-R disparity.

3. The psychological condition of testing, structured in terms of "commitment," does influence the amount of generalization of expectancy estimates. In an individual testing situation (presumably more committed) there is less generalization of expectancy statements following "failure" on a related task than in a comparable group testing situation. The effect of degree of explicitness in original estimates on the generalization of estimates was suggestive but not definitive.

4. On the whole, expectancy statements tend to be more stable than minimal goal statements.

5. There are some significant sex differences in relation to the generalization of expectancy statements. Males tend to show less generalization of expectancy statements following obtained "failure" on a related task than females.

These and a number of other supplementary findings were discussed in terms of their theoretical and research implications. 121 pages. \$1.65. Mic 56-3520

## INDIVIDUAL DIFFERENCES IN RESISTANCE TO EXTINCTION AS A FUNCTION OF GENERALIZED EXPECTANCY

(Publication No. 18,814)

John Willard Neff, Ph.D.  
The Ohio State University, 1956

The major purpose of the study was to test the hypothesis that individual differences in persistence in the face of failure are a function of generalized expectancies held by individuals. The following experimental hypothesis was formulated to predict individual persistence: (1) there will be a significant positive correlation between initial expectancy statements and trials to extinction.

Part of the rationale for the first hypothesis was that a change in reinforcement would lead to a recategorization of the situation, and that the recategorization would be related to generalized expectancy. Two additional hypotheses were formulated to test this rationale: (2) there will be a significant positive relationship between initial expectancy statements and the expectancy statements on each of the first three extinction trials in a continuously reinforced situation; (3) there will be a significantly higher correlation between initial expectancy statements and the expectancy statements on each of the first three extinction trials in a continuously reinforced training situation than in a partially reinforced training situation.

It was further hypothesized that: (4) partial reinforcement in a training situation will lead to a significantly greater number of trials to extinction than will continuous reinforcement.

A fifth hypothesis was formulated to test the logical hypothesis that individual differences will be less predictable as the measure for the prediction becomes more inclusive: (5) there will be a significantly higher correlation between initial expectancy statements and trials to extinction than between incomplete sentences blank scores and trials to extinction. Although the predictability of two measures may differ, it was hypothesized that: (6) there will be a significant positive correlation between initial expectancy statements and incomplete sentences blank scores.

A skill task, difficult color matching, was employed, and two conditions of reinforcement, partial and continuous, were used to test the hypotheses. Two measures of generalized expectancy were utilized: initial expectancy statements and general adjustment scores on the Rotter Incomplete Sentences Blank. The subjects were divided into three experimental groups; two groups underwent conditions of continuous reinforcement, one group received partial reinforcement. The measure of persistence was the number of trials necessary to reach extinction.

The results supported Hypothesis I in two of the three experimental situations. Although the predictiveness was low, it was statistically significant. The limited predictiveness was explained in terms of error of measurement. The failure of the data from the second of the two continuously reinforced groups to support the hypothesis was not readily explainable. These findings suggest that persistence in the face of failure is related, to a limited extent, to the level of generalized expectancy in the situation.

Hypotheses II and III were not supported by the data. It was concluded that, within the limits of this study, a change in reinforcement as an impetus to recategorization

of a situation as a new situation is insufficient. Hypothesis IV was also not supported. The inconsistency of these results with those of other partial reinforcement studies was attributed to the kind of task employed--a skill task. Most other studies have employed chance tasks.

Hypothesis V was not supported by the obtained data. The low predictiveness of initial expectancy statements may have served to lower the probability of finding differences between the predictiveness of the two measures of generalized expectancy. Hypothesis VI was supported by the data obtained from the partial reinforcement group and also when all subjects were grouped together. These findings suggest that the two measures of generalized expectancy tend to measure, to a limited extent, the same concept.

97 pages. \$1.50. Mic 56-3521

#### THE RELATIONSHIP BETWEEN DIFFERING AMOUNTS OF NEONATAL ANOXIA, DISCRIMINATION LEARNING, AND FRUSTRATION

(Publication No. 18,672)

Arthur Reis Orgel, Ph.D.  
The Florida State University, 1956

The research was an attempt to produce in the laboratory a structural predisposition to non-adaptive behavior in rats. The basic premise from which the hypotheses for testing were derived is that severe neonatal anoxia impairs the structure of organisms to a degree that they will demonstrate a decreased potential for developing and maintaining adjustive behaviors (learning) and an increased potential for developing and maintaining non-adjustive behaviors (abnormal fixations).

The experiment was devised to test four hypotheses. 1) Animals experiencing neonatal anoxia will have greater difficulty in learning a discrimination problem than control animals, the difficulty increasing in relation to the severity of anoxia sustained. 2) In an insoluble problem situation, anoxiated animals will be more susceptible to the development of fixated responses than control animals, susceptibility increasing in relation to the severity of anoxia sustained. 3) Anoxiated animals will be more resistant to the extinction of abnormal fixations, resistance increasing in relation to the severity of anoxia sustained. 4) Anoxiated animals will have greater difficulty in re-learning a discrimination problem than control animals, the difficulty increasing in relation to the severity of anoxia sustained.

Four groups of rats were employed, one control group and three groups that had been subjected to three different levels of severe neonatal anoxia. At maturity the animals were taught to discriminate two cards in the Munn discrimination box. After they had reached a criterion of 95% correctness, the problem was rendered insoluble by punishing responses in a random fashion. "Frustration" runs were continued for 200 trials or until subjects had developed abnormal fixations. For those animals that fixated, the problem was again rendered soluble, and they were given alternate "guidance" and trial-and-error trials in the apparatus until the fixations were broken. Subjects were then required to re-learn the discrimination to the original criterion.

The differences between the groups in discrimination

learning are in the predicted direction but fail to reach significance. Not enough animals developed abnormal fixations to warrant tests of the differences between groups. The results are discussed in terms of the previous research in this area and in the context of the learning and "frustration" theories of abnormal fixations. Explanations are offered for the failure to obtain abnormal fixations with the Munn discrimination box and with the particular strain of rats employed.

55 pages. \$1.50. Mic 56-3522

#### A STUDY OF THE SELF-CORROBORATING CHARACTER OF THE SCHOOL BEHAVIOR PATTERNS OF AGGRESSIVE AND WITHDRAWN CHILDREN

(Publication No. 17,663)

Raymond Parker, Ph.D.  
New York University, 1956

Chairman: Professor Brian E. Tomlinson

The purpose of this investigation was to determine the nature of the interaction processes between teachers and school children with deviate behavior patterns, that is, aggressive and withdrawn children. The study was designed to test the hypothesis that the interaction processes between teachers and children served to confirm and reinforce the pre-existing deviate behavior patterns of the children.

The population consisted of 71 boys and 22 teachers. The children were characterized by their teachers as aggressive, as withdrawn, or as well-adjusted. They were drawn from the third through the sixth grades of a public elementary school in a low socio-economic area of The Bronx, New York City.

A Test of Children's Expectations of Teacher Behavior, designed by the investigator, consisted of 22 cartoons depicting classroom situations. Each child in the study specified the teacher's reaction in each cartoon. The test was validated, and the reliability of the investigator's scoring established, in a Pilot Study. The test gave a measure of whether the child expected positive or negative behavior from teachers.

A Rating Scale of Aspects of Teacher Behavior toward Pupils consisted of 20 items. Teachers checked whether the behavior indicated tended to occur, for each child in the study, often, with moderate frequency, or rarely or never. The Rating Scale provided a measure of the quantity and quality of the teachers' behavior toward the children.

A sociometric device required the children in all classes in the study to name those of their peers liked and those disliked by the teacher. The results indicated the pattern of the distribution of the teacher's approval and disapproval for the children in the study, as this pattern was perceived by the class.

Findings on the several measures were subjected to both statistical and qualitative analysis.

Based upon the population studied, the following conclusions were drawn:

1. Aggressive children, as compared with well-adjusted children, expected teachers to be more critical

and restrictive. Particularly in situations involving pupil non-conformity, the aggressive children expected a degree of severity far in excess of the requirements of the situation.

2. Well-adjusted children tended to expect teacher criticism in response to minor infractions of classroom decorum.

3. There was no evidence of a difference in the expectations of the withdrawn and well-adjusted children. The lack of a difference relative to the quantity of teacher behavior anticipated may be a result of the insensitivity of the test used to this dimension of measurement.

4. Well-adjusted children received a large measure of teacher approval and very little disapproval. Aggressive children received large amounts of disapproval and proportionately little approval. Withdrawn children received less approval than either of the other groups, less disapproval than the aggressive group, and approximately as much disapproval as the well-adjusted group. The aggressive group received the most attention; the withdrawn group the least.

5. Aggressive and withdrawn children tended to expect the kind of teacher behavior they actually received. Withdrawn children lived in an atmosphere of an attenuated level of interaction with the teacher, but the existing interaction was largely positive in character. The quality of their expectations was positive, but no adequate measure was available of the anticipation of the quantity of teacher behavior.

6. Although group differences were distinct, there was also a large degree of overlap amongst the groups and many individual variations within the groups.

7. There was a wide variety of dynamic patterns of pupil-teacher interaction. The same behavior had vastly different psychic meanings for different children characterized as similar on the basis of classroom adjustment.

8. Children whose classroom behavior was well-adjusted were not necessarily well-adjusted in terms of personality development.

171 pages. \$2.25. Mic 56-3523

#### SOME DEVELOPMENTAL CONCOMITANTS OF RIGID BEHAVIOR

(Publication No. 18,513)

Klaus Warner Schaie, Ph.D.  
University of Washington, 1956

An analysis was made of studies of developmental changes in adult behavior and explanatory models using the concept of "behavioral rigidity" were considered. An attempt was then made to ascertain whether age changes in intellectual ability can be predicted from a knowledge of an individual's standing on measures of such "behavioral rigidity."

Alternate models for the relationship between developmental changes in the Primary Mental Abilities (Thurstone) and measures of rigid behavior were formulated. Hypothesis I stated that maintenance of intellectual ability is a function of "flexibility," in which case a positive and systematically increasing relationship between measures of ability and rigidity-flexibility would occur with increasing

age. Hypothesis II stated that both intellectual ability and behavioral rigidity show concomitant age changes and that the latter would serve to predict the former at every age level, in which case a high positive relationship should be found throughout the adult age span, with somewhat decreasing correlations due to the restriction of range in the older age groups. Hypothesis III finally stated that while age changes in the mental abilities and rigidity-flexibility occur, they would show no systematic relation and zero or spurious correlation was to be expected.

A sample of 500 adults ranging in age from 20 to 70 years, subdivided into five-year age groups, each containing 25 men and 25 women, was drawn from a pool of approximately 18,000 potential subjects, who were members of a pre-paid medical plan. The personal characteristics of the members of the sample are described and it was concluded that they were reasonably representative of a large portion of the socio-economic continuum.

The subjects were tested with Thurstone's S.R.A. Primary Mental Abilities test and with Schaie's Test of Behavioral Rigidity. Information was also obtained on measures of family status, socio-economic level and mobility.

Significant age changes were found on all measures of mental abilities and behavioral rigidity. There was considerable difference in the decrement shown on the different measures, in the ages of peak performance for the different abilities, in the changes in variability and the rate of decline.

Correlations were computed between the measures of rigidity and mental ability and an analysis of variance and covariance was used to test the principal hypotheses. The correlations between the measures of rigidity and the mental abilities were found to be significantly high throughout the adult age span with a tendency to decrease towards the upper end of the age continuum. When the analysis of covariance was used to adjust the between-group differences on the mental abilities for the effect of rigidity, significant differences remained.

On the basis of this evidence Hypothesis I was not verified, but Hypothesis II which stated that behavioral age changes occur concomitantly with increasing difficulty of adjustment to change and that the level of functioning for individuals at any given age level may be predicted from knowledge of the rigidity-flexibility dimension seems to be supported.

As a final step, all subjects were rank-ordered in terms of the composite rigidity score, and means were computed for the ten most rigid and ten most flexible individuals in each age group. The analysis of variance showed mean differences to be significantly in favor of the flexible individuals on practically all variables, providing additional support for Hypothesis II.

163 pages. \$2.15. Mic 56-3524

**SOME CHANGES IN PSYCHOMETRIC, PERCEPTUAL AND MOTOR PERFORMANCE AS A FUNCTION OF SLEEP DEPRIVATION**

(Publication No. 17,670)

John H. Seymour, Ph.D.  
New York University, 1956

The problem of this study was: what are the measured changes in perceptual, motor and psychometric responses of normal individuals as a function of sleep deprivation. Observable behavioral changes were also considered.

The 13 subjects were male and female chosen on the basis of availability and were tested at the Tau Delta Phi, Kappa chapter fraternity room of New York University. The subjects were deprived of sleep for 60 hours from Friday morning at 7:00 A.M. to Sunday night at 7:00 P.M. Three subjects were tested one week-end and ten the next week-end. The subjects were tested at 6:00 P.M. Friday, 4:00 P.M. Saturday, and 6:00 P.M. Sunday.

The battery of tests consisted of four motor tests--Hand Dynamometer, Pursuit Rotor, Purdue Pegboard and the Card Sorting test; four perceptual tests--Reaction Time, Flicker Fusion, Autokinesis and Eidetic Imagery; and five psychometric tests--Cancellation, Digit Symbol subtest of the Wechsler-Bellevue scale, Wechsler Memory Scales, the Thematic Apperception Test, and the Rorschach.

The following tests showed significant differences:

1. Poorer performance on the Card Sorting Test at the height of stress ( $P < .05$ ).
2. Better performance on the Cancellation Test after 30 hours of deprivation ( $P < .05$ ), and poorer performance on the Cancellation Test after 60 hours of deprivation ( $P < .05$ ).
3. Better performance on the Purdue Pegboard Test after 30 hours ( $P < .01$ ) and 60 hours of deprivation ( $P < .01$ ).
4. Impaired performance on the Autokinesis Test after 30 hours ( $P < .01$ ) and 60 hours of deprivation ( $P < .01$ ).
5. A decreased W% on the Rorschach Test at the height of stress ( $P < .02$ ).
6. An increase in emotionally-laden statements on the TAT at the height of deprivation ( $P < .01$ ).

Motor, perceptual and structured psychometric performance are not appreciably affected by 60 hours of sleep deprivation. Unstructured psychometric performance, represented by the Rorschach and TAT, is more susceptible to change under stress than psychophysical measurements.

In addition to comparing the group with reference to their performance on the prescribed tests, various factors within the records were analyzed.

1. Deviant behavior, as well as test patterns, were highly individual.
2. Personality, and the emotional life of the individual, is more greatly affected by stress than psychophysiological factors.
3. Those individuals who evidence pathological signs at the height of stress only, do not have different test patterns.
4. Those individuals who evidenced pathological signs on initial testing, either through the self-evaluation obtained from the STDCR Inventory or from pathognomonic

Rorschach and TAT's, show no different test pattern during and at the height of stress.

5. Individuals with erratic behavior during the experiment do not show different test patterns.

The results were discussed and interpreted in terms of the theory that fatigue and impairment are strongly influenced by the entire organization of an individual including his long term ideas, goals and self-evaluation. The importance of using projective techniques in future experiments involving sleep deprivation was also discussed.

196 pages. \$2.55. Mic 56-3525

**THE DIFFERENTIAL EFFECTS OF ANCHORS AND ANCHOR-SEQUENCES ON THE TEMPORAL JUDGMENTS OF SHORT INTERVALS BY SCHIZOPHRENIC AND NORMAL SUBJECTS**

(Publication No. 19,356)

Alvin D. Weinstein, Ph.D.  
University of Houston, 1956

The purpose of this investigation was to study the effects of anchors and anchor-sequences on the estimations of a short standard duration by normal and schizophrenic subjects in an attempt to answer the following questions which were suggested by Lhamon and Goldstone's previous research:

1. Do both schizophrenic and normal subjects consistently estimate a second to be shorter than a standard second under different anchor and sequence conditions; i.e., how pervasive is the tendency to estimate a short second?
2. Are the estimations of schizophrenic patients consistently less than those of normal controls under different anchor conditions; i.e., how pervasive is this tendency in schizophrenia?
3. Do anchors influence the estimations of schizophrenic patients?
4. Does sequence influence the estimations of schizophrenic patients?

Schizophrenic and normal subjects compared the duration of presented tones with their subjective concepts of one second before and after information about the duration of the physical standard under different anchor and sequence conditions. Forty normal and 23 schizophrenic subjects individually estimated the durations of three series of temporal stimuli anchored respectively at 0.1 second, 2.0 seconds and 0.1 second following information; 40 normal and 23 schizophrenic subjects individually estimated the durations of three series of temporal stimuli anchored respectively at 2.0 seconds, 0.1 second and 2.0 seconds following information; 41 normal and 36 schizophrenic subjects individually estimated two series of temporal stimuli anchored respectively at 1.0 second before information and 1.0 second after information. A method of limits technique for presentation of stimuli was employed according to accepted psychophysical procedure. The data were statistically analyzed using a Lindquist Type III analysis of variance design.

The following results were demonstrated by this investigation:

1. Both normal subjects and schizophrenic patients overestimated a 1.0 second duration regardless of anchor or sequence conditions, the patients significantly more so than the normals.
2. Anchors had a significant general effect on the estimations of a brief temporal duration by both normal and schizophrenic subjects.
3. Anchor-sequences produced significant main effects on the temporal estimations of normal subjects but not on those of schizophrenic patients.
4. Information had a significant effect on the temporal estimations of both normal and schizophrenic subjects.

These findings were discussed in terms of the concepts of "frames of reference" and "autism." It was suggested that the tendency for normal subjects to overestimate a brief temporal interval indicated that time was experienced by them to pass more slowly than it actually did. The generally consistent and significantly greater temporal overestimations of the schizophrenic patients were noted to be in line with clinical observations about the autistic, inner-directed person's temporal concepts and were interpreted as a defensive maneuver designed to relieve the patient's internal tensions. The threat of external reality implied by consensual standards to the patient's psychic equilibrium and the apparent inability of patients to utilize past information in making current judgments was also discussed.

Within the limits of the present investigation, it is concluded that anchors and anchor-sequences differentially affect the temporal estimations of normal and schizophrenic subjects, and that these findings present implications for the further elucidation of the function of time experiences in both normal and schizophrenic processes. It is recommended that the reliability and validity of the methods employed in the present study be investigated further, and it is suggested that these methods hold promise for the future investigation of a variety of factors influencing temporal experiences.

94 pages. \$1.50. Mic 56-3526

## PSYCHOLOGY, EXPERIMENTAL

### EFFECT OF FIRST-ORDER CONDITIONAL PROBABILITY IN A TWO-CHOICE LEARNING SITUATION

(Publication No. 19,066)

Norman Henry Anderson, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor David A. Grant

Two experiments on learning in a two-choice guessing situation are reported. The first-order conditional probability in the sequence of stimulus events, defined as the

probability that an event occur in the present trial given that it occurred in the preceding trial, was the main independent variable. Each event was required to occur with probability 1/2 so that the value of the conditional probability completely characterized the (stochastic) structure of the sequence of events. The dependent variable was frequency of repetition responses, defined as the response of predicting next that same event which happened last. Group designation numbers are 100 times the conditional probability used in their acquisition condition. Thus, a group given initial training with a conditional probability of 0.7 is called Group 70, etc.

In Exp. 1, 120 subjects were run in a 3x2 design using trial rates of 5, 7.5, and 10 seconds, and conditional probabilities of 0.3 and 0.7. All groups received 200 acquisition trials. The 5, 7.5, and 10 second groups were given 300, 200, and 100 transfer trials, respectively. In the transfer condition, the conditional probability had the value 1/2, giving a completely random sequence. Final acquisition response rates were fairly stable at about 34% for Groups 30, and about 79% for Groups 70. Final response rates in transfer were between 60% and 70% for Groups 70, and 50% for Groups 30. Analyses of variance showed that conditional probability in acquisition had significant effects both early and late in acquisition. Similarly, the response rates of Groups 30 and 70 were significantly different both early and late in the transfer trials. The standard error of the mean for groups of 20 subjects ran from 2% to 2.5%. Trial rate had no significant effects either in acquisition or in transfer, in any of the main analyses, although slight interaction effects with sequences were found in subsidiary tests. Some indications that different random sequences produced different behavior, even over 50 trial blocks, were also found.

Exp. 2 was a parametric study of effect of conditional probability, using the 5 second trial rate of Exp. 1. Eleven groups, each with 20 to 40 subjects, were given acquisition training at values of this variable ranging from 0 to 1 in steps of 0.1. Groups 0 and 100 were treated somewhat differently and will not be discussed here. The remaining groups received 300 acquisition trials, followed without pause by 200 trials in a transfer condition using a completely random sequence. Tests for recovery were made after intervals of two to six days.

Mean terminal acquisition response rates of 4, 16, 35, 49, 62, 75, 84, 90, and 94 percent were obtained for Groups 10 through 90, respectively, with standard errors ranging from 0.7% to 2.5%. Significant differences in final performance in transfer were also found, with Groups 10-40 clustering around 50%, Groups 60-90 clustering around 70%, and Group 50 continuing at a stable rate close to 60%. Significant recovery after rest was obtained.

Tabulations of response frequencies conditional upon subsequences of two and three preceding stimulus events were made for all groups over all trials. Similar compilations were made for subsequences of length four for Groups 30, 50, and 70. From these data, differences of conditional frequencies for subsequences differing only in the most remote event were computed. These results showed that the third preceding event, and in at least one case, the fourth preceding event, exerted significant effects on the current response. The differences showed some changes with practice, but little systematic variation with experimental treatment was seen.

Three mathematical models, based on statistical

learning theory were found to be inadequate to account for the results. The possibility that memory traces representing the past several events and responses were serving as stimuli for the current response was discussed within the framework of Estes' conceptualization of the stimulus, and certain arguments for this view were adduced from the data.

Instances of unexpected results, as well as some data on individual behavior, were also considered.

64 pages. \$1.50. Mic 56-3527

**TRANSFER OF TRAINING AS A FUNCTION OF STIMULUS-RESPONSE RE-PAIRING AND AMOUNT OF PRACTICE ON TRAINING TASK**

(Publication No. 18,779)

Armand Neil Chambers, Ph.D.  
The Ohio State University, 1956

The verbal-learning experiment under discussion investigated negative transfer as a function of stimulus-response "re-pairing" and amount of practice on the training task under this condition. In the re-pairing paradigm, the stimulus and response items are the same on the training and transfer tasks, but the response items are recombedined on the transfer task to produce different pairs of stimulus-response items. This paradigm is symbolized as A - B; A - B<sub>R</sub>. It has been predicted to produce considerably more negative transfer than the situation in which a "new" response is made to an "old" stimulus and symbolized as A - B; A - C.

The experiment compared the A - B; A - B<sub>R</sub> and A - B; A - C conditions and three levels of practice on the training task for each of these negative transfer paradigms. Criteria for the levels of practice on the training task were: 7/10 correct in one trial, one perfect trial, and four perfect trials. A trial was defined as one complete presentation of the ten pairs of adjectives that were used as learning materials. Three different lists of ten pairs of adjectives were used: A - B, A - B<sub>R</sub>, and A - C. The paired associate method was used, and the lists were presented on a memory drum at a 4-second rate. The transfer task was given 24 hours after the training task. A warm-up task consisting of numbers was given immediately preceding the transfer task. Criterion level in the transfer task was one perfect trial. Twenty-four subjects served in each of the six groups; none had any previous experience in verbal learning experiments or served in more than one condition. Seventeen males and 127 females participated.

The experiment provided statistically significant evidence of negative transfer in the A - B; A - B<sub>R</sub> condition but no evidence for positive or negative transfer in the A - B; A - C condition. Although there were no significant differences in the transfer task as a function of amount of practice on the training task, sufficient evidence of trends was obtained to suggest that, for the re-pairing condition, negative transfer is at a maximum for intermediate levels of practice (the one perfect criterion in this study) and decreases for both higher and lower levels of practice. These results are comparable to those that have been obtained in previous studies for the A - B; A - C

condition. The trends do not suggest that the maximum amount of interference necessarily occurs when the level of practice is similar on both tasks.

On the basis of existing information it is suggested that the negative transfer produced under the re-pairing condition is best explained by assuming that, because of the similarity of the tasks, there are more sources of interference in the A - B; A - B<sub>R</sub> condition than in the A - B; A - C condition and, therefore, more opportunity for generalization (or confusion) between both the stimulus and response items. If the trends obtained in the study for the effects of amount of practice are valid, discrimination between stimulus items (including the response items as stimuli) is a more influential factor in explaining the effects of practice than the strength of the associations between stimulus and response items.

35 pages. \$1.50. Mic 56-3528

**EFFECT OF VISUAL DIRECTIONAL DYNAMICS ON PERCEPTION OF ILLUSORY AND REAL MOTION**

(Publication No. 18,076)

Peter Elia Comalli, Jr., Ph.D.  
Clark University, 1956

Supervisor: Heinz Werner

This thesis is concerned with the general problem of the expressive qualities of perceptual objects, and more specifically with that aspect of expressive qualities called directional dynamics. Directional dynamics refers to the fact that some perceptual objects express a vectorial quality definable in terms of direction and force.

Six experiments were conducted which demonstrate that visual directional dynamics exist as a behaviorally measurable event. This demonstration has been carried out by studying the effect of directional dynamics upon two kinds of motion, autokinetic and real. It has been found that autokinetic motion predominantly occurs in the direction of the dynamics of the observed object, namely, with dynamics left the predominant direction of motion is to the left; with dynamics right it is to the right. With regard to real motion the evidence from all the experiments, in general, supports the hypothesis that a moving observed object with dynamics in the direction of motion appears to move faster than an object without directional dynamics or an object with dynamics opposite the direction of motion.

An additional finding dealt with the problem of individual sensitivity to expressive qualities and its relation to assumed habitual ways of viewing the world. The assumption here is that artists habitually view the world more in terms of the expressive qualities, whereas scientists are characteristically oriented more toward geometric-technical qualities. There is some evidence in the present experiments that directional dynamics more potently affects both autokinetic and real motion with a group of artists than with a group of scientists (chemists). Since directional dynamics is an instance of expressive qualities, these findings then lend support to the proposition that sensitivity to expressive qualities is related to habitual ways of viewing the world.

69 pages. \$1.50. Mic 56-3529

**TRANSFER EFFECTS RESULTING FROM REINFORCEMENT OF IRRELEVANT CUES**

(Publication No. 18,780)

Theodore Eugene Cotterman, Ph.D.  
The Ohio State University, 1956

One hundred twenty male college students learned to respond to pairs of solid and outline circles and triangles by making a check mark corresponding with the correct stimulus in one of a pair of squares on an answer sheet. Following each pair, a check mark was presented in the same position as the correct stimulus. The stimuli and check marks were presented by means of a strip film projector, the subjects controlling the rate of speed by means of a push button. All subjects worked through a practice series twice, a training series seven times, and a test series four times. The practice series contained the words "dog" and "cat" paired ten times, while the training and test series contained thirty-two pairs of stimulus figures. Trials were separated by a 42-second interval, and a 4 1/2-minute interval separated presentation of training and test series. Subjects were assigned at random to eight groups of equal size. The three pairs of experimental groups were trained with triangle always correct and solidness (as an irrelevant cue) associated with it 25, 50, and 75 per cent of the time respectively. Subsequently, one of each pair was tested with the solid stimulus always correct (triangle associated with it 50 per cent of the time), and the other of each pair was tested with the outline stimulus always correct. The two control groups were both trained and tested with one stimulus aspect--for one the solid figure, and for the other the open figure, always being correct.

On the basis of Wickens' theoretical formulation and the assumption that learning is continuous, it was expected that greater percentages of irrelevant association would lead to greater positive transfer. Test performances as measured by trial time and errors were found ordered in this manner. However, since only two groups differed reliably, these predictions cannot be regarded as confirmed.

49 pages. \$1.50. Mic 56-3530

**SUMMATED RESPONSE OF THE RETINA TO LIGHT ENTERING DIFFERENT PARTS OF THE PUPIL**

(Publication No. 18,789)

Jay Martin Enoch, Ph.D.  
The Ohio State University, 1956

The data of previous investigators for the additivity effect, defined as the summed response of the retina to light entering different parts of the pupil, have been contradictory. A study was undertaken in an attempt to delineate the variables inherent in these measurements.

The experimental results have demonstrated that additivity data are not affected by coherence or non-coherence of phase in the retinal plane. Thus, the Maxwellian and the ordinary type of viewing may be used interchangeably in Stiles-Crawford and additivity effect experiments.

The experiments conducted in this research have revealed that additivity data are affected by at least the

following two factors: (1) the differing degrees of luminous efficiency of rays incident at varying points in the entrance pupil (the Stiles-Crawford effect) and (2) the blur of the retinal image.

When blur is eliminated in additivity studies, the Stiles-Crawford effect does not reduce perceived brightness as much as might be predicted.

The blur effect caused by ocular aberrations, spherical and chromatic aberrations in particular, is a variable dependent upon the observer. This variability is thought to account for the several discrepancies in the data found in the literature. Initial experiments concerning the effect of blur on perceived brightness have been completed, and it was shown that blur reduces perceived brightness of a field. Experimentation demonstrated the flicker photometer method to be the method of choice if it is necessary to match a blurred field with a clear one.

A new formula for the Stiles-Crawford effect has been introduced, and a possible mechanism has been suggested which gives theoretical significance to the formula.

135 pages. \$1.80. Mic 56-3531

**CONSTRUCTION OF A FORCED-CHOICE TECHNIQUE FOR THE EVALUATION OF COLLEGE STUDENTS' GOALS**

(Publication No. 18,790)

Edwiges de Carvalho Florence, Ph.D.  
The Ohio State University, 1956

The purpose of the study was to construct a forced-choice technique for the evaluation of college students' goals. The main underlying assumptions are the following: (1) The behavior of college students is motivated. This motivation is strong and persistent. (2) College students' behavior is goal-directed, i.e., has directionality. (3) The goal-attaining response has rewarding properties for college students. (4) The functional relationship between college students' behavior and a goal may be described in terms of a motive. (5) Ideally, the forced-choice technique would reflect both the direction and magnitude of the students' motivation.

The steps followed in the construction of this technique were as follows: (1) Five hundred behavioral descriptions were primarily obtained from 60 essays on the successful student's behavior written by college students. (2) The contents of these behavioral descriptions suggested to three experts the following five major areas of motivation: activities; scholastic achievement; moral values or standards of conduct; social, non-organized activities; self-adjustment. (3) Sixty items were selected by the three experts as best descriptive of these areas. (4) A Descriptive Check List, Forms I and II, was constructed and used for determining the degree of applicability of each item in describing a representative sample of 200 college students. A graphic rating scale was prepared and used for determining how successful the rater would consider the student he had previously described by means of the check list. (5) Preference Index (P.I.), Discrimination Index (D.I.), and Standard Deviation (S.D.) were computed for each item. A factor analysis of the five areas of motivation yielded one general and five group factors.

They were respectively identified as: over-all attitude, organizational leadership, scholastic achievement, ethical conformity, social acceptance, and self-adjustment factors. (6) Behavioral descriptions were selected and arranged on the basis of the P.I., D.I., and factor loadings.

The constructed forced-choice was entitled "Student Behavior Description: Preference-Ranking and Preference-Choice." The rationale of the Preference-Ranking is as follows: When a student is faced with the ranking of five types of goal-oriented behavior which are equated on both the general (P.I.) and specific (D.I.) external reinforcement values, he performs the ranking on the basis of his own differential reinforcement values (factor loadings). The ranking from most to least descriptive of each of the 20 five-item sets by the student will reflect the directionality of his motivation. The rationale of the Preference-Choice is as follows: When a student is presented with two choices among five types of goal-oriented behavior having equivalent general external reinforcement values (P.I.'s) but different specific external reinforcement values (D.I.'s), he makes his choices according to the higher specific reinforcement values if he is strongly identified with (college) group goals. However, if he is identified with the general (total culture) college group, he makes his choices at random and only occasionally selects a higher as opposed to a lower specific reinforcement valued behavior. The five items of a set have equivalent P.I.'s, but two items are paired on the basis of a higher D.I., and two on the basis of a lower D.I. The fifth item has a D.I. midway between these two pairs. The student's choices of the two items in each of the 20 five-item sets which are most descriptive of himself will reflect the magnitude of his motivation. Scoring procedure and directions for the administration of the Student Behavior Description were developed.

192 pages. \$2.50. Mic 56-3532

#### THE PERCEPTION OF PERSONS: AN EXPLORATORY STUDY OF SOME OF THE DETERMINANTS OF SELF PERCEPTION AND SOCIAL PERCEPTION

(Publication No. 18,078)

Robert Granville Harlow, Ph.D.  
Clark University, 1956

Supervisor: John E. Bell

This research has been an exploratory attempt, using a psychoanalytic frame of reference, to investigate some of the determinants of the perception of persons. The term perception of persons refers to the appraisals that an individual makes of himself or of another person. Two conditions postulated to influence the perception of persons were investigated: (1) intra-personal conflict in the perceiver, and (2) the nature of the perception or judgment required.

More specifically it was hypothesized that the greater the intra-personal conflict concerning a personality attribute the greater would be the likelihood of the operation of perceptual defense (one area of operation of ego defensive mechanisms). Perceptual defense, it was assumed, would be manifested both by a generalized 'inaccuracy' of

appraisal or perception, and by a consistent tendency to be 'inaccurate' in a specific fashion in appraisal or perception. With respect to the second determinant, it was hypothesized that the particular perceptual task or judgment required would involve the consistent use of different (in kind or degree) perceptual defenses. Systematic differences in the magnitude of appraisal on different judgmental tasks was assumed to reflect the operation of different (in kind or degree) perceptual defenses.

The subjects were 28 girls from a private boarding school, all of whom knew each other well. The personality attributes appraised were hostility, sex, self concept, and self sufficiency. Three judgmental tasks were employed: the self rating; the rating of the others as the rater thinks that other really is (the true rating); and the rating of the other as the rater thinks the other will rate herself (the predicted rating). The data were tabulated both for absolute 'accuracy' of appraisal, independent of direction of deviation (the absolute score); and for the direction of 'inaccuracy' of appraisal (the algebraic score). Thus, there was a measure of perceptual defense per se (the absolute score); and a measure of perceptual exaggeration or perceptual minimization, the particular perceptual defense employed, the algebraic score. The TAT was the independent measure for evaluating conflict and the ego defenses of the subjects.

Results were obtained which were consistent with the prediction that the greater the conflict concerning sex, the more 'inaccurate' would be the predicted ratings of others on sex. However, contrary to prediction, the greater the conflict concerning sex, the more 'accurate' was the self rating of sex. This latter result was reasoned to be most likely due to an artifact in determining the 'accuracy' of self rating; that is, that others' social perceptions were taken as the standard for the self perception. It was suggested that one's self perception may be a more accurate (in the absolute sense of the word) appraisal of oneself than are one's social perceptions an accurate appraisal of other persons.

Significant relationships were found between the characteristic defenses employed for sex and self concept and the nature of the perceptual defenses against sex and self concept. The relationship for self concept was in the predicted direction, that is, that there was commonality of defense in two areas of personality functioning. The relationship for sex was in the opposite direction from that predicted, that is, that there was an inverse relationship between the defenses employed in two areas of personality functioning. It was suggested that different areas of personality functioning (e.g. fantasy and perception) may elicit the use of different defenses as a function of the attribute being defended against.

With respect to the second major determinant, significant differences were found in the magnitude of appraisal as a function of the nature of judgment required. This was consistent with the notion of the use of different perceptual defenses for different perceptual tasks. Of particular interest were two propositions inferred from the data: (1) that a heretofore inadequately considered phenomena, the projection onto others of the prohibitions associated with an attribute may be an important mechanism for defending against consciously experienced (un-repressed), but anxiety producing attributes, and (2) that societal prohibition against a specific form of expression

of an attribute may influence the nature of the perceptual defenses employed by the group as a whole in the appraisal of that attribute. 138 pages. \$1.85. Mic 56-3533

**AN EXPLORATORY INVESTIGATION OF THE PERCEIVED SIZE OF AN OBJECT IN RADIAL MOTION**

(Publication No. 18,799)

William Frank Hubbarth, Ph.D.  
The Ohio State University, 1956

The purpose of the dissertation was the exploratory investigation of the perceived size of an object in radial motion. The problem had been hitherto uninvestigated. The approach was twofold: the establishment of a method for measuring apparent size of an object in motion with suitable apparatus; and the use of this method for the exploratory isolation and investigation of certain factors in the situation.

A new tachistoscopic exposure technique in connection with a Constant Process method was proposed and subjected to experimental investigation. The method was investigated for possible influences of temporal summation affecting brilliance of the matching device, and was compared with another common method of apparent size measurement.

Variation of exposure from .025 sec. to .100 sec. produced no significant differences in apparent size matches for four subjects when they matched stereoscopic projections of photographs of white squares taken at distances of 6, 12, 24, and 48 meters. There were no significant differences between the proposed method and the other method.

A stimulus presentation apparatus making use of a model train engine and a trestle was constructed to govern the rate and axis of motion of the target. The apparatus was arranged for investigations in the radial axis.

The variables chosen for investigation were: close examination of the size-distance function when the object was stationary at 2-meter intervals throughout the range of distances (3 - 15 meters), the comparison of approaching and receding motion at these distances, and the influence of increasing rate of speed upon the phenomena.

It was found, in extensive investigation of two subjects, that:

1. The data from the stationary and motion analysis indicated a change in function at an approximate distance of 10 meters from the subject. This break point was sharply indicated.

2. Motion had no effect upon the apparent size matches at distances greater than the break point. From 3 meters to the break point, a difference existed between approaching and receding motion, approaching motion producing progressively less larger values as the break distance was approached.

3. Increasing the rate of speed of the object from .72 M/sec. to .90 M/sec. produced no change in size matches.

The results were discussed, with possible hypotheses advanced in explanation. Future research is outlined. It was concluded that certain factors in the size perception of an object in motion have been shown worthy of more extensive investigation. 93 pages. \$1.50. Mic 56-3534

**AN INVESTIGATION OF THE EFFECT OF THE SIZE AND SHAPE OF AN APERTURE UPON APPARENT SIZE AND SIZE CONSTANCY**

(Publication No. 18,804)

Richard Stanton Laymon, Ph.D.  
The Ohio State University, 1956

Two experiments were designed to study some of the environmental factors which influence apparent size and size constancy.

Experiment 1 investigated the effect of the size of the visual field as expressed by varying the size of an aperture from 126° horizontally by 113° vertically to 5° horizontally by 5° vertically in five steps. Judgments of apparent size were made at three distances of 5, 10, and 20 meters from the aperture by five observers.

Experiment 2 investigated the effect of the shape of the visual field as expressed by varying the horizontal and vertical dimensions of an aperture, keeping the area constant. Three aperture shapes were used: one 50 centimeters vertically by 2.5 centimeters horizontally; another 2.5 centimeters vertically by 50 centimeters horizontally; and the third 11.18 centimeters vertically by 11.18 centimeters horizontally. The aperture area for all of the above conditions was 125 square centimeters. A fourth condition was used as a check on Experiment 1 and to utilize an aperture whose horizontal and vertical dimensions were 2.5 centimeters in order to discover whether the minimum dimension was the important factor operating. Apparent size measurements were made by five observers at distances of 5, 10, and 20 meters from the aperture.

The results of these experiments led to the following conclusions:

**Experiment 1**

- (1) As the size of an aperture decreases, the apparent size of a target seen through the aperture decreases.
- (2) The maximum decrease of apparent size occurs when the central part of the visual field is reduced.
- (3) There is a trend, though not significant, for size constancy to decrease as the aperture size decreases.
- (4) There are large individual differences in apparent size and size constancy.
- (5) There is a significant interaction between people and the size of an aperture.

**Experiment 2**

- (1) A square aperture of the same area as an aperture whose primary dimension is either in the vertical or horizontal dimension results in larger judgments of apparent size.
- (2) The vertical aperture produced larger judgments of apparent size than a horizontal aperture of the same area.
- (3) The minimum dimension of an aperture is not the important factor in apparent size matches.

- (4) There are no significant changes in size constancy as a result of changing the shape of an aperture.
- (5) There is a significant interaction between people and the shape of an aperture.

The results as a whole point out the importance of the central and vertical parts of the visual field as effective determinants of apparent size. Apparent size and size constancy are probably related to the observer's ability to see how far away the target is.

68 pages. \$1.50. Mic 56-3535

#### A COMPARISON OF THREE METHODS FOR ESTIMATING VALIDITY

(Publication No. 18,806)

David Bimberg Learner, Ph.D.  
The Ohio State University, 1956

The purpose of the study was to evaluate two methods of estimating validity between predictors and criteria with regard to the standard correlational technique.

The J-coefficient is a job analysis approach to validity. It is based on estimates of overlap between predictors and job elements, and between job elements and success on the job. Job elements were originally developed from job analysis information; however, in this study judges were asked to assign percentage overlap between orthogonal factors (used as elements) and the predictors and the criterion. In addition, the judges were required to indicate the direction of the overlap as well as its magnitude. The assigned percentages were transformed to correlations (factor loadings), and the mean value of the loadings became the correlation between the element ( $r_{ep}$ ) and the test, or the elements and the job ( $r_{ec}$ ), for each of the ten variables and the single criterion.

The reliability of the assigned factor loadings for the six judges averaged only .31 for the predictors. This was due primarily to the unusual curvilinear nature of the variables and the assumed difficulty of assigning direction to the overlap. The J-coefficients computed by the formula  $J_{pc} = \sum r_{ec} r_{ep}$  tend to be higher and less variable than the real validity coefficients. The validity of the ten J-coefficients for the real correlations was .81.

The inferential ex post facto validity method is based on three criteria of goodness and their attendant statistical tests. In order of their application these are: (a) test of mean differences of after-the-fact test scores of passes and failures in Naval Air Training; three out of ten variables proved to discriminate beyond the five per cent level of confidence. These selections were maintained by (b) applying the ratio  $\frac{r}{\sigma_r} \geq 1$  and eliminating those variables that did not fulfill this requirement. When the differences were transformed to correlations and correlated with the experimental results, the validity was .52. However, these inferred validities correlated .69 with the J-coefficients, indicating a flexibility of choice between the two approaches. As a test of reliability, each ex post facto sample was correlated with the experimental sample. Although training effect might shift the mean scores, the relative overlap of the three distributions would remain constant unless

training had differential effects on the three samples. In this case, the direction of overlap of the three distributions would shift, and such a shift would be reflected in the signs of the correlation. Consequently (c) the signs of the correlation from (a) and the two subsequent tests must be consistent in direction. The three selected variables met this criterion.

As an estimate of the relative efficiencies of the three validity approaches, positive and negative integral weights were assigned, and composite correlations were computed. On the basis of nine variables the conventional approach had a validity of .50. The J-coefficient provided validity of .45 with eight variables. The inferential approach provided validity of .35 with three selected variables. Obviously, there are differences in predictive efficiency between the methodologies. However, their alternative practical efficiency is a value judgment best estimated by each experimenter.

The relative value of the two methodologies and their potential use in training research and systems analysis suggest that they are at least worthy of future experimentation.

51 pages. \$1.50. Mic 56-3536

#### STUDIES OF SERIAL DISCRIMINATION LEARNING BY RHESUS MONKEYS

(Publication No. 19,109)

Robert Wilding Leary, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harry F. Harlow

Four independent studies were conducted. Each was concerned with a different aspect of discrimination learning, but all utilized a serial technique of stimulus presentation. The standard procedure was to give several successive runs through a list composed of several pairs of multidimensional objects. The pairs were presented one after another, so that between the appearance of a pair on any run and its reappearance on the next run, all the other pairs would appear. Reward was a small piece of food placed under the correct object in each pair. New lists were prepared each day.

The subjects were sophisticated rhesus monkeys. A group of nine was used in all four studies, and a separate group of six in the second study only.

In the first study, there were ten runs per day through nine-pair lists for a total of twenty-five days. Gradual improvement in accuracy was observed over the first three five-day periods with little if any improvement between the fourth and fifth periods, wherein second run accuracy averaged over 75 per cent correct. Analysis of errors indicated a tendency to choose on later runs an incorrect object chosen on the first run.

A partial departure from the standard procedure was made in the second study. Here, in Condition P, pairs were presented in a different order on each run, and, in Condition O, the order of the correct objects was maintained but the incorrect objects were re-paired with different correct objects on each run. In Condition C, a fixed order of pairs prevailed. Each monkey served as his own

control. This experiment lasted three days. In a second similar experiment lasting six days, a new group of six monkeys was used. Approximately equal performance occurred in Conditions C and P, but a significantly inferior performance occurred on the later runs (Runs 5-7) in Condition O. A detailed analysis indicated that the results were compatible with the continuity theory as elucidated by Kenneth Spence.

In the third study, the subjects were tested for nine days on discrimination reversal after one, three, or six pre-reversal runs through eight-pair lists. In pre-reversal learning, choices were over 80 per cent correct on Run 2 and over 90 per cent correct on the fourth run. Increasing pre-reversal practice beyond one run led to a significant decrease in efficiency of reversal learning. On the initial post-reversal run, about 20 per cent correct responses occurred. This indicated a tendency to "spontaneous" breakdown of the pre-reversal habit.

The last study began with a one-day experiment in which a two-peanut reward was given on four of the pairs and a half-peanut reward was given on the other four pairs. In a second experiment, utilizing eight of the nine subjects, four ten-pair lists were presented, each under a different condition to each monkey. The ratio of two-peanut to half-peanut rewarded pairs in these conditions was (1) 0 : 10, (2) 10 : 0, (3) 5 : 5, and (4) 2 : 8. Approximately equal efficiency of performance was found in the two constant-reward conditions. Overall efficiency was reduced in the mixed-reward conditions. In the first experiment and the third condition of the second experiment, many more errors occurred on the half-peanut pairs than on the two-peanut pairs. 95 pages. \$1.50. Mic 56-3537

#### AN EXPERIMENTAL INVESTIGATION OF SENSITIVITY TO INCREMENTS AND DECREMENTS IN CONTINUOUS FRONTAL PLANE TRANSFORMATIONS OF VISUAL FORMS

(Publication No. 17,396)

John Atwell Moody, Ph.D.  
The Ohio State University, 1956

It was the purpose of the studies to compare systematically the sensitivity of human subjects, as measured by probability of response, to continuously changing increments with their sensitivity to decrements produced in frontal plane rectangular transformations, and to attempt identification of some of the factors related to this phenomenon.

Three experiments were performed in which subjects made absolute judgments of the change in size of rectangular forms whose dimensions changed continuously in either one or two dimensions at subliminal rates.

In the first experiment, increments and decrements in the size of rectangular figures were generated by projecting light through masking plates driven at 0, .006, .012, .018, and .024 inches per second on a translucent screen. Four subjects made absolute judgments on one- and two-dimensional changes in size of these forms. The psychophysical functions indicated a significantly greater probability of response to increments than decrements when a one-dimensional change took place, while greater

probability of response to decrements than increments occurred when two-dimensional changes took place.

In the second experiment, increments and decrements were produced by means of a Clason Visual Acuity Meter driven at a constant rate such that the dimensions of the stimulus figures projected on a translucent screen increased or decreased continuously in one or two dimensions at a rate of .036 inches per second. Equal increments and decrements were alternately presented to each of 16 subjects, the direction of change being reversed only when the subject responded correctly to a size change. In this way deviations from an initial stimulus size were cumulated. The cumulated deviations tended toward the larger two-dimensional figures and toward smaller one-dimensional figures, which indicated a greater sensitivity to two-dimensional decrements than increments and a greater sensitivity to one-dimensional increments than decrements. These results corroborated the results of the first experiment.

A third experiment was performed in which the same apparatus and stimulus specifications as those in the second experiment were used, but only the two-dimensional change was used. As pretrials before every run, each subject was exposed to stimuli by the same method that was used in the second experiment. From these pretrial data the results of the first two experiments were again corroborated in that the cumulated deviations tended in the same directions as in the second experiment. In the main body of this experiment, increments and decrements were presented to each of the 16 subjects in simple alternating patterns and in more complex multiple-step patterns. The results based on Chi-square analyses indicated a greater sensitivity to the increments than to the decrements in spite of the evidence that more intra-serial effects existed between responses in the simple situation than in the more complex situation.

It was concluded from these experiments that physically equal increments and decrements were not equally detectable, and that the phenomenon could not be explained in terms of physical or physiological effects. The difference does not appear to be due to effects that have been described by other workers as time or space errors, nor can it be adequately accounted for by intra-serial effects or simple guessing habits. Neither can it be completely explained by principles such as Weber's Law. However, continued investigation of the increment-decrement relationship by the use of reversed brightness relations, different psychophysical methods, different stimuli, and different sense modalities should yield information sufficient for the formulation of a psychological theory to account for the effect.

In summary, the writer believes that the judgment errors here reported represent a consistent effect, not emphasized previously in the literature, for which no adequate explanation now exists.

75 pages. \$1.50. Mic 56-3538

**EFFECT OF METHOD OF PRESENTING VARIED AMOUNTS OF FOOD INCENTIVE ON PERFORMANCE BY MONKEYS**

(Publication No. 19,139)

Allan Martin Schrier, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Harry F. Harlow

Two experiments were conducted on monkeys to test the hypothesis that facilitation of performance by a given amount or quality of food incentive will vary as a function of other amounts or qualities of food incentive presented for the performance of a task. In general previous findings suggest that when larger amounts or more preferred qualities of food are presented in the same situation as is a given amount or quality, the result will be a decrease in facilitation of performance by the given amount or quality, but, when smaller amounts or less preferred qualities of food are presented in the same situation as is a given amount or quality, the result will be an increase in facilitation of performance by the given amount or quality.

In the first experiment, the performance measure was latency of response to a single object covering a baited foodwell. In the second experiment, efficiency of response on successive object-discrimination problems was measured. At the beginning of the experiments, the monkeys were divided into two groups, the "Range" ( $n = 5$ ) and "Restricted" ( $n = 19$ ) Groups. The Restricted Group was divided into four subgroups. A different one of four amounts of food, 1, 2, 4 or 8 pellets, was always presented to the animals of each subgroup for the appropriate response: a displacement of the single object in the latency experiment, or a correct response in the discrimination experiment. Each animal of the Range Group was repeatedly presented all four incentive amounts, the particular amount being varied from trial-block to trial-block in the latency experiment, and from problem to problem in the discrimination experiment. Differential facilitation of performance by the same incentive amounts when presented by the different methods was to be expected if the hypothesis were true. More particularly, it was expected that the "incentive function"--the term used to indicate the relationship between performance and the amount of incentive--for the Range Group would have a greater slope than the incentive function for the Restricted Group.

When latency of response was measured, it was found that the two methods of incentive presentation did not result in significantly different incentive functions or in a significant difference in over-all performance by the groups. The difference in the slope of the functions was, however, in the predicted direction. This fact together with the low power of the statistical test suggested further experimental tests of the hypothesis employing latency measures.

When efficiency of response on object-discrimination problems was measured, the two methods of presenting identical incentive amounts resulted in significantly different incentive functions. The slope of the incentive function for the Range Group was significantly greater than the slope of the incentive function for the Restricted Group. The difference in the over-all level of performance of the two groups was not significant.

Experiments on monkeys have uniformly shown a

positive and significant relationship between response efficiency and amount of food incentive, whereas results of experiments on rats have been inconsistent regarding this relationship. The present findings suggest that the consistent use of the Range-Group method of presenting the incentives in the previous monkey experiments, in contrast to the almost consistent use of the Restricted-Group method in the rat experiments, is a major reason for the difference in the results of experiments on the two species.

118 pages. \$1.50. Mic 56-3539

**DISCRIMINATION OF INTERMITTENT PHOTIC STIMULATION IN THE RAT WITHOUT ITS STRIATE CORTEX**

(Publication No. 18,756)

Arthur S. Schwartz, Ph.D.  
The University of Buffalo, 1956

Much has been written concerning the involvement of the optic cortex in visual intensity discrimination, but little is known concerning its function in flickering-steady light discrimination. This problem is important because of the great interest in CFF, in the physiological effects of intermittent photic stimulation (IPS) and in the role of the visual cortex in the retention of visual habits. There is some implication in the literature that flicker discrimination in the rat is possible without its striate cortex, but no data exist to show that the rat can learn to act differently when confronted with IPS rather than a steady light after ablation of this neural structure. The problem of this research was to train rats to perform a conditioned discrimination to an intermittent light and study the behavior after removing the striate cortex.

Six of fourteen albino rats learned successfully to run to an intermittent photic stimulus and not to run to a steady light in the shuttle avoidance box. Following surgical removal of the striate cortex, the six rats were retrained on the second postoperative day, and then again from fourteen to nineteen days after operation. All six rats relearned the discrimination, and showed some retention of the original habit in terms of training trials saved to meet a criterion.

The animals were then checked on their ability to learn both a brightness and a pattern discrimination on a modified Lashley jumping stand, and compared to a normal group. The operated learned a brightness discrimination with somewhat more difficulty than the normals, but failed to learn a pattern discrimination in 112 trials. The normals learned the latter in less than 19 trials. Histological examination of the lateral geniculate bodies showed complete cellular degeneration in these structures, verifying the conclusion from the jumping stand data that the surgical procedure had destroyed completely the geniculo-striate system of all the six operated rats.

That the rat can discriminate IPS without its striate cortex de-emphasizes the role of the cortex, and the striate cortex in particular, in IPS discrimination in lower animals. It suggests that other mechanisms, possibly subcortical, may play an increasingly important role in this discrimination and in CFF as one descends the phylogenetic scale.

The finding of some postoperative retention, in contrast to intensity discrimination studies where no retention has been found, implies that the neural mechanisms involved in the latter type of discrimination are significantly different from those involved in IPS-steady discrimination. However, an alternate possibility was also raised: the type of learning situation may be crucial for demonstrating the different roles of the striate cortex in brightness and IPS discrimination. 54 pages. \$1.50. Mic 56-3540

**PROTEIN DEFICIENCY AS AN INDEPENDENT MOTIVATIONAL FACTOR IN THE MAZE PERFORMANCE OF DOMESTIC NORWAY RATS**

(Publication No. 19,290)

Roderick Joel Senter, Ph.D.  
University of Cincinnati, 1956

The purpose of the two experiments composing this dissertation was to investigate certain motivational aspects of protein deficiency. The two experiments are abstracted separately.

**Experiment I**

Two groups of 10 rats each were maintained on a protein deficient diet for 30 days. A third group was fed an adequate diet for the same period of time. One of the deficient groups and the adequately fed animals were then run to a low protein goal object on a multiple "T" maze to a learning criterion of two errorless repetitions. The remaining deficient group (the experimental group) received a high protein goal object in the maze. All animals were fed their respective diets immediately before each maze exposure.

The experimental group exhibited better maze performance than the deficient animals running to the low protein goal object. Due to the influence of extraneous activity drive the adequately fed animals receiving the low protein goal object (which they rarely ate) performed as well as the experimental group.

The conclusions drawn from this experiment were as follows:

1. Protein deficiency can independently produce a qualitative drive of sufficient strength to motivate the learning of a complex maze by domestic Norway rats.
2. Qualitative drive resulting from protein deficiency works in accordance with the law of effect and the principle of reinforcement, and is effective in motivating learning only when reduced by the consummatory response.
3. The hypothesis that homeostatic disbalance, which cannot be corrected by internal adjustment mechanisms, results in overt striving on the part of the organism directed toward reinstatement of homeostasis is substantiated.

**Experiment II**

Eight protein deficient rats were trained to run a straight runway to a protein-rich goal object. The animals

were fed their day's ration of protein deficient food prior to each training session. After training, the animals' deficiency was eliminated by feeding them super-normal amounts of an adequate diet for 10 days. The rats were then given 50 extinction trials on the runway with the protein-rich goal object as an incentive. The rats' runway running behavior persisted throughout the "extinction" trials even though they were neither hungry nor deficient. Secondary reinforcement was deemed to be causative.

The conclusions drawn from this experiment were as follows:

1. A protein-rich food can acquire secondary reinforcement value through repeated association with the reduction of a primary drive resulting from protein deficiency.
2. Although the results of this experiment do not definitely prove or disprove either theory of self-selection they tend to refute one aspect of the gustatory sensitization theory, i.e., that elimination of primary need for a specific nutritive substance will lead to the immediate cessation of an animal's self-selection of that substance.

219 pages. \$2.85. Mic 56-3541

**THE INFLUENCE OF REWARD AND PUNISHMENT IN A MINIMAL SOCIAL SITUATION**

(Publication No. 18,444)

Joseph B. Sidowski, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor David A. Grant

**Problem.** In the present study we attempt to reevaluate the essential features of a social situation viewed entirely within the framework of conditioning theory, and to investigate the simplest situation that could be considered truly social within this framework. In this analysis we will assume that the main factors controlling social behavior are reward and punishment. Within this framework the essential features of a minimal social situation may be expressed as follows: (a) Two or more Ss have at their disposal responses which result in rewarding and punishing effects on other Ss. (b) The principal sources of reward and punishment for any S depend on responses made by other Ss. (c) The responses controlling reward and punishment are subject to learning. We assume that, whatever else may be involved, at least the above features are present in any social situation. In the present experiment an attempt was made to place S in a situation involving only these minimal features.

**Procedure.** Two Ss, isolated from each other, were provided with two push buttons by means of which each could give the other reward or punishment, specifically, score or shock. The Ss, 90 pairs, were divided into two major groups, an Informed and an Uninformed group. All Ss in the Informed group were told that another S was serving in the experiment and that the other S controlled his shocks and scores. In the Uninformed groups, the effects of previous social learning were minimized since Ss were not told that they were in a social situation at all.

The two major groups were subdivided into three Reward-Punishment subgroups in which: (1) Ss could give each other Shock Only, (2) Ss could give each other Score Only, and (3) Ss could give each other both Shocks and Scores. This resulted in a total of 6 experimental groups.

**Results.** The number of score responses and the number of shock responses were analyzed in blocks of 5 minutes over the entire 25 minute experimental session. A finer analysis of the individual minutes of the first 5 minutes was also carried out.

The results indicate clear evidence of learning, i.e., score responses increased even in the first 5 minutes of the session. The shock responses, however, did not seem to decrease or increase during the entire session. Reward seemed to be more effective than punishment alone, and a combination of reward and punishment was highly effective. In addition to the above, it was found that social information added nothing. An investigation of the conditional sequences of responses showed that the only sequence of responses that increases markedly in the groups that learned was that in which the score response of one S was followed by the score response of the other.

**Conclusions.** Within the framework of the present experiment, we may conclude that learning was demonstrated in a minimal social situation in those groups where Ss had an opportunity to receive a reward, defined in terms of a score on a counter. Learning for Ss under these conditions occurred regardless of whether or not S was told that another S was serving in the experiment. Subjects who were led to believe that they were serving in the experiment alone, learned to make score responses as well as or better than Ss who were told that another S controlled the amount of shock and score which he would receive. These results indicate, therefore, that Reward-Punishment conditions were the major factors controlling the behavior of Ss and that awareness of the sociality of the situation had little effect. Finally, the differences in the shock and score groups, the theoretical requirement of dominance of reward in order that learning can take place, and the specific increase in the number of score followed by score sequences point to the greater weight of reward over punish-

ment in this minimal social situation.

63 pages. \$1.50. Mic 56-3542

#### PRIMARY STIMULUS GENERALIZATION AS A FUNCTION OF ACQUISITION LEVEL IN THE CAT

(Publication No. 19,147)

Richard Frederick Thompson, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Wilfred J. Brogden

The present experiment investigated primary stimulus generalization in the cat, as a function of level of acquisition. Auditory stimuli varying in frequency were employed. All animals were conditioned to a 250 cps tone to 20%, 55%, or 90% acquisition levels (per cent response in a block of 20 trials) and then extinguished at 250, 500, 1000, 2000, 4000, or 8000 cps to a criterion of 20 responseless trials. The animals extinguished at 250 cps served as the control group for measures of relative generalization. The animals were conditioned to give a running response in the Brogden-Culler rotary conditioning apparatus.

Using number of trials up to and including the first response failure in extinction, and number of responses in the first 20 extinction trials as measures, total number of responses decreased with increasing generalization test frequency, and increased with increasing acquisition level. For relative generalization, the above two measures were employed by dividing the individual experimental group scores by the control group (250 cps) means. Relative generalization was found to increase from 20% to 55% acquisition levels, and then decrease to 90%, for 500 and 1000 cps test frequencies, to be inversely related to acquisition level for 2000 and 4000 cps test frequencies, and to be zero for all acquisition levels for 8000 cps test frequency.

The results obtained confirm most previous work on the subject, and would seem to indicate that in acquisition training to a single stimulus, some sort of discrimination process is involved. 74 pages. \$1.50. Mic 56-3543

#### RELIGION

##### MOTIFS OF THE BIBLICAL VIEW OF TIME

(Publication No. 19,260)

Henri Marc Yaker, Ph.D.  
Columbia University, 1956

The problem of time is central for an interpretation of the relevance of the Bible for classical and contemporary life. Examination of the motifs of the biblical view of time is conducted in two ways: (1) by a lexicographical study of Hebrew and Greek words which are recurrent as motifs of time; (2) by an examination of certain theological concepts which have been of importance in biblical history. In the first part of the study the Hebrew terms for time, viz., 'eth, 'olam, dabhar, etc., and the Greek terms for

time, viz., chronos, kairos, aion, and kosmos are examined. Conclusions are drawn from this examination. In the second part of the study the themes of Passover, the Day of the Lord, the Temple at Jerusalem, and the Sabbath are examined in terms of their biblical importance, and the conclusions of the first part are reinforced. While the examination is primarily in terms of biblical literature, portions of classical Greek literature, the Septuagint, the rabbinical and non-canonical, biblically-related literature are also considered.

One of the major conclusions of the study is that there is no doctrine of "eternity" in the Bible, but only the conception of endless time. An interesting feature of the study is the suggestion that the Greeks did not develop any doctrine of time which was radically different from the

biblical conception until the time of Plato. From the time of Plato and afterwards, there were Greek views of time radically different from the Bible.

A second conclusion is that the biblical view of time defines a particular answer to the question: what is the place of man in the "world"? Unphilosophical in its outlook, the Bible rejects the concept of a totality of world-order or kosmos which is independent of time and history. For the metaphysical kosmoi are timeless levels of reality. The biblical kosmos is a spatial distribution of things, an arrangement ("cosmetic array") of things-in-time. While there is no explicit doctrine of creation ex nihilo in the Bible, time is the essential category, maintaining, nevertheless, the reality of things. The biblical world, being neither sub specie aeternitatis nor sub specie temporis, is a world of things which abide in time, from the "first to the last of days". An eschatology comes out of this view: man is called to realize the possibilities of the experienced hour, rather than to make history meaningful by injecting the supra-temporal or "eternal" into the temporal.

A third conclusion is that the biblical view of time clearly repudiates the cultic theme, a theme which unfortunately reappears too frequently in modern religious thought. The cultic view of nature is cyclical and inherently dependent upon a spatial world. The time of history is controlled by nature. The Bible rejects this view, controlling the time of nature by the time of history. "Remembrance", a major biblical theme, is not identical with representation of the past--the former involves time.

The biblical view of time is relevant to modern philosophy of religion. It repudiates that type of metaphysics which gives priority to nature rather than to history. In terms of the biblical view of time it is suggested somewhat tangentially that the philosophy of Martin Heidegger and the theology of Rudolf Bultmann can be criticized. Such a criticism at once implies that the biblical view of time is relevant for modern studies.

364 pages. \$4.65. Mic 56-3544

## SOCIAL PSYCHOLOGY

### SOCIAL JUDGMENTS AS A FUNCTION OF TEMPORAL SEQUENCES OF STIMULI

(Publication No. 19,079)

Clinton Burgel De Soto, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Associate Professor J. C. Gilchrist

In these studies Ss judged the bizarreness of items of behavior described briefly on slips of paper. Scaled bizarreness values from 1 to 13 had been obtained previously for a pool of stimulus items. The independent variable was the sequence of scaled bizarreness values of the items judged, approximated as successions of stimulus frequency distributions.

In study I, Ss judged items by sorting them one at a time into 13 ordered piles representing increasing bizarreness. Two stimulus distributions were used, one rectangular over stimulus values 2.9 to 10.0 (a wide distribution, low on bizarreness), the other composed of items with values 10.5 to 11.4 (a narrow distribution with all items considered equivalent, high on bizarreness). Ss who were given 40 preshift trials on items from the high distribution and then shifted to the low distribution for 32 postshift trials gave the latter items lower (less bizarre) mean judgments than did Ss who judged them initially. This difference was greater for the higher-valued items of the low distribution. Other Ss judged the low distribution for 0, 4, 8, 16, or 32 preshift trials, then judged the high distribution for 40 postshift trials. Their postshift judgment means were at first an increasing, negatively accelerated function of number of preshift trials, but converged over further postshift trials.

In studies II and III two narrow stimulus distributions were used, one high (7.8 to 9.9), one low (4.8 to 6.4). Two

judgment categories, more and less bizarre, were used. These restrictions were intended to minimize problems involving the interval nature of the original scaling and the evaluation of frequency distributions of judgments, and to increase connectibility with probability learning research. Added controls denied Ss observable evidence of past judgments and held reading and judging times constant.

In study II, Ss judged low items for 0, 4, 8, or 32 preshift trials, then judged high items for 64 postshift trials. The empirical probability of a high (more bizarre) judgment for early postshift items was an increasing, negatively accelerated function of number of preshift trials. The probabilities for the different conditions converged over further trials toward an asymptote of .5. The probability of a high judgment for low items also converged to .5 from a lower starting value attributed to S's pre-experimental experience.

Study III concerned alternating subsequences or series of 8 low and 16 high items. Within all four low series, the probability of a high judgment increased toward .5 over trials; within all four high series, it decreased toward .5. These changes were slower for later series. The probability of a high judgment dropped over successive low series until the third. At this stage an equilibrium seemed to exist in which the probability of a high judgment for a high item  $P(J_H|S_H)$  and that for a low item  $P(J_H|S_L)$  could be expressed as a function of the frequencies of high items  $P(S_H)$  and of low items  $P(S_L)$  according to these simultaneous equations:

$$P(J_H|S_H)P(S_H) + P(J_H|S_L)P(S_L) = .5,$$

$$P(J_H|S_H) - P(J_H|S_L) = .5.$$

The judgment changes over trials in study II seemed

to involve more than first-order dependencies. There were sizeable individual differences in all studies which were relatively unaffected by other factors such as trials. These findings may complicate the application of stochastic models to judgment processes.

61 pages. \$1.50. Mic 56-3545

#### SOME EFFECTS OF BIAS ON LEARNING

(Publication No. 17,306)

John Thomas Doby, Ph.D.  
The University of Wisconsin, 1956

Supervisors: The late Professor Thomas C. McCormick  
and Professor William H. Sewell

#### 1. Statement of the Problem.

##### A. Basic Assumptions.

The general problem of this dissertation is the effects of previous learning upon subsequent learning among human subjects. The basic theoretical assumption which this research makes is that present learning is continuous with past learning.

Certain assumptions were also made regarding the antecedent conditions under which much past learning occurs. These assumptions were (1) the more generalized and vague the learning situation is, the greater the probability for strong affective arousal, and hence the more persistent the learned connections. (2) The more vague and general the initial conditions of learning are, the more difficult it is for the subject to achieve the necessary discriminations and differentiations to permit the extinction of learned connections. (3) In general, a subject will tend to accept statements in harmony with the attitudes of his social groups and reject statements in conflict with these; therefore, any real change in a subject's ideas and attitudes would be related to similar changes in his reference groups. Thus, if a subject has learned biased answers under the conditions implied in the foregoing assumptions, it would be anticipated that he would have difficulty in extinguishing the wrong answers for the purpose of subsequently learning the right answers.

##### B. The Problem.

With these general assumptions in mind, the specific problem may now be stated: Does bias interfere with subsequent learning?

#### 2. Research Procedures.

For purposes of this study, bias is defined as any mistaken notion or misconception resulting from previous learning. Operationally, bias is defined as  $\frac{\Sigma W}{N}$ , where  $\Sigma W$  is the sum of the statements answered wrong on a pretest by a given subject, and  $N$  is the total number of statements to be answered. Each statement could be answered in one of three ways: as true, false, or "don't know." "Non-biased" is taken to mean that a subject does not know the answer to a statement, and says that he does not know. Operationally defined, "non-biased" is the sum of the

"don't know" responses of a given subject expressed as a percentage of the total number of statements on the pre-test. Symbolically this is expressed as  $\frac{\Sigma D.K.}{N}$ .

The major hypothesis is: subjects will have more difficulty in learning the right answers to statements initially answered wrong than to statements initially answered "don't know." The theoretical proposition assumed by this hypothesis is that bias interferes with subsequent learning.

The general procedure of the study was to give to a sample of college freshmen systematic instruction about a group of statements on which they had given both biased and unbiased answers in a pretest; to withhold instruction on a similar group of statements and then compare the rate of learning of the right answers on statements which the students previously had given biased answers with the rate of learning of the right answers on the statements for which they had given non-biased answers for both the taught and non-taught groups of statements.

#### 3. Results and Conclusions.

After having made adequate tests to ensure that the instruction was effective, the primary hypothesis was tested. This hypothesis was that there would be significant differences in the rates of learning from the pretest to the test in respect to biased and unbiased statements. Appropriate statistical analysis confirmed this hypothesis. Consequently, the major conclusion of the research is that the answering of a statement wrong on a pretest significantly interferes with subsequent learning.

The influence of intelligence and interest on the learning of the right answers to statements on which both biased and unbiased answers had been given was assessed by multiple and partial correlation techniques. Also, the effect of stress on test performance was assessed by the same techniques. The major results were: A significant positive relationship was found between intelligence and the subsequent learning of the correct responses to statements initially answered wrong. Interest was found to be unrelated to the learning of the right answers to statements initially answered wrong, but there was a significant positive relationship between interest and the learning of the right answers to statements initially answered "don't know." The hypothesis that stress interferes with a subject's performance on a true-false type of test was not confirmed.

212 pages. \$2.75. Mic 56-3546

#### A STUDY OF DEVIANT SEXUAL-OCCUPATIONAL CHOICE BY TWENTY NEW YORK WOMEN

(Publication No. 19,242)

Harold Greenwald, Ph.D.  
Columbia University, 1956

An intensive study of twenty "call girls" (independently operating, expensive, prostitutes) was made to explore whether there were personality characteristics or life-history patterns which were related to their occupational choice.

While there did not seem to be any literature devoted

to the "call girl" per se, the vast literature about prostitution was sampled to show the wide variety of explanations that have been offered for the existence of prostitution and prostitutes.

The twenty subjects were divided into two groups of ten each. One group was interviewed by the writer and the other by one of three trained volunteer interviewers who were, themselves, "call girls." The interviews were primarily of the open-end variety and comparison was made between the techniques and results obtained by the writer and the volunteer interviewers.

The setting within which the girls operated was described, as well as some of the skills and natural attributes of the professional "call girl."

The sample ranged in age from 19 to 43 years and in education from 8 to 14 years. Fourteen of the subjects had been married at least once, and seven were mothers. Three of the subjects' parents were upper class, 14 middle class and 3 lower class.

The psychodynamics involved were presented in terms of the developmental pattern; the symptoms and the contributions they may have made to the emotional predisposition to choosing the profession of "call girl"; and the variety of defenses employed by the subjects in their attempts to handle their anxiety and guilt.

In order to determine the differences between the subjects and other deviants, a comparison was made with a group of anti-Semites studied by Ackerman and Jahoda which indicated that unlike the anti-Semites, the "call girls" internalized their guilt with resultant self-hate and depression.

### Conclusions

1. Characteristic life-history patterns included: felt bi-parental rejection; absence of clear identification with either parent; drifting into deviant sexual behavior; and finding groups which accepted such behavior.
2. Personality traits characteristic of the group included: manifest signs of anxiety; confused self-images; and disturbed ability for inter-personal relations.
3. The role of "call girl" seemed to play a significant identifiable part in the current emotional life of the particular girls which included: denial of homosexuality and frigidity; search for proof of feminine attractiveness; integration of aggressive and ingratiating drives.
4. Becoming a "call girl" could not be explained purely as a reaction to economic needs without reference to emotional factors. Choice of occupation was related to such personal needs as: ability to express hostility to the family for early felt rejection; and the search for affection.
5. Developmental factors that predisposed certain of the girls to a predisposition to prostitution were: broken or unloving homes; early rewarded sexual relations; and lack of family ties leading to feelings of isolation.

127 pages. \$1.70. Mic 56-3547

### AN EXPLORATORY STUDY OF ALTRUISM

(Publication No. 18,818)

Salomon Rettig, Ph.D.  
The Ohio State University, 1956

Behavior, according to social learning theory, is a function of (1) the expectancy that a particular behavior will lead to a goal, and (2) the reinforcement value of the goal. The reinforcement value of a goal is a function of the degree to which it has led in the past to subsequent reinforcements.

The study attempted to investigate the type of experience in the parental homes of college students which exerts a significant influence upon altruistic behavior. Four major home influences were hypothesized: (1) the direct reinforcement of altruistic behavior by parents, through the administration of rewards and punishments, (2) the altruistic behavior of the parents themselves, (3) the religious reinforcements of altruistic behavior, and (4) home circumstances which call for altruistic behavior.

Measurement of altruistic behavior was obtained by means of a self-constructed altruism scale in which the expectancies were partially controlled on a cultural predetermined basis, a blind student test in which the subjects were asked to volunteer to aid blind university students, and a questionnaire test in which subjects were asked to volunteer to help a graduate student by taking a questionnaire.

Measurement of the home-background influences was obtained by means of a self-constructed inventory.

Three samples were used in the study. Samples 1 and 3 consisted of 204 and 59 elementary psychology students respectively; the second sample was a class of 108 seniors and graduate students in the school of education. All of the students attended a large Midwestern university.

In the relationship between the various home influences and the altruism scale, only the altruistic behavior of the parents presented a consistently significant influence in all three samples. Direct reinforcement and religious reinforcement were significant influences in the case of the elementary psychology students primarily, while circumstantial reinforcement was a significant factor in the case of the upper-class education students only.

The altruism scale differentiated significantly between the volunteers and non-volunteers in the blind-student test in the first sample. This differentiation did not occur in the second sample because of a change in the administration of the blind-student test. The blind-student test was not administered to the third sample because the data collected in this group were obtained anonymously. The questionnaire test showed no differentiation.

Significant sex differences in the responses to the altruism scale occurred in the first and third samples, the females indicating higher altruism. No other consistent significant sex differences were obtained in this study, although there was a tendency for more female students to volunteer on the blind-student test.

On the basis of the results it is suggested that the direct reinforcement and religious reinforcement of altruism may have an immediate effect. This effect tends to disappear with increased separation from the parental home. Circumstantial reinforcement of altruism may show its influence only following an extended period of separation from the parental home, at a time when persons

become ready to establish their own homes and raise their own children. The influence of parental altruistic behavior seems to show its effect in the immediate situation and may be maintained for a prolonged period of time.

Most of the results obtained in the study were on a verbal level only. The behavioral tests suggested great specificity in their elicitation of altruistic behavior. The use of a larger number of different behavioral tests seems indicated for the demonstration of generality of altruistic behavior. Finally, all of the measuring instruments utilized in the study require additional refinements.

110 pages. \$1.50. Mic 56-3548

#### CORPORATE MEMBERSHIP AND INDIVIDUAL VALUES

(Publication No. 17,671)

Charles Louis Shaffer, Ph.D.  
New York University, 1956

#### The Problem

The purpose of the investigation was to determine the relationship of an individual's values to his membership location in his business organization. The specific problems of the study were: Relationship of value systems to employee's length of service, rank attained, departmental membership, size and type of organizational affiliation. Value systems were examined for the following factors: Value priority system for each group, extent of value system differences among groups, and extent of conformity with value systems held within groups.

#### Procedure

The Allport-Vernon Study of Values scale was used to determine value preferences for 322 employees from the New York City area. Answers to a questionnaire were used to categorize employees on the corporation membership variables. Treatment of data was accomplished as follows:

The median and semi-inter quartile range were used to measure central tendency and variability of group values.

The Chi-square was used in determining the significance of differences found among groups.

Phi and Contingency coefficients were used to show relationships among variables.

The "D" test was utilized to express similarity among group profiles.

#### Results

The sample could be characterized as being high in economic, theoretical, and political values; average in religious, and low in aesthetic and social values.

The sample was heterogeneous in value preferences. Significant differences were found on all variables tested.

Length of service correlated significantly positive with social and religious values; and negative with political, aesthetic, and economic values.

Increased rank in the organization correlated significantly positive with theoretical and religious values; and negative with aesthetic and political values. Advanced age and high rank were associated positively, but negatively

associated were advanced age and aesthetic and economic values.

Aesthetic values correlated significantly negative with increased organizational size, and social and religious values correlated negatively with increased organizational size.

Of the five departmental comparisons - sales, accounting, production, research, and personnel - the latter two showed the greatest differentiation, due to the fact that research put high emphasis on theoretical, and personnel, on religious values.

Organizational type categorization indicated that consulting firms have the most unique profile. The economic and aesthetic value scales resulted in the greatest differentiation among organizational type comparisons.

Old, low rank, personnel department, and consulting organization employees showed the greatest profile similarity to that of the general population. Sales department, production organizations, new, and small organization employees showed the greatest profile similarity to that of the entire business sample.

No significantly greater conformity of values was found with increase in organization size or employee length of service. Significantly greater conformity of values was found for old, low rank when compared with old, high rank employees.

#### Conclusions

Employees showed significant differences in their value preferences when categorized by length of service, rank attainment, departmental membership, size, and type of organizational affiliation.

The values associated with business education, length of service, and increased organizational size are, in many cases, not the values being rewarded, as measured by rank in the business organization. The values associated with doing, theoretical and aesthetic, are being de-emphasized in business education in comparison with economic and religious values.

Suggestions are made regarding the re-structuring of college business education, improved cooperation between college and in-company education, and decentralization of business organizations with the goal in mind of stressing intrinsic rather than extrinsic motivation and developing a more rounded employee.

Hypotheses regarding the relationship between religious values and paternalism, political and competition, aesthetic and job structuring are advanced. The possibility of using the Study of Values as a measure of organizational dynamics is discussed.

121 pages. \$1.65. Mic 56-3549

#### CHILD TRAINING AND CHILD PERSONALITY IN A RURAL AND URBAN AREA OF CEYLON

(Publication No. 18,446)

Murray Arnold Straus, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor William H. Sewell

Scope and Method. A study of all third standard children in the highland Sinhalese village of Wattapola, Ceylon

and every third child in this grade in the Maradana Central School, Colombo, Ceylon, was designed to (1) test the relation between personality and selected socialization variables, (2) study the effect of urbanization on child rearing in Ceylon, (3) test the theory of national character and modal personality, and (4) obtain a deeper understanding of Sinhalese society through a study of Sinhalese personality. The sample children were tested using the California Test of Mental Maturity, the California Test of Personality, and the Rorschach technique. The mothers of these children were interviewed with the aid of an interview schedule supplemented by informal observation.

Sinhalese Society. Sinhalese society is described as "loosely structured." By this is meant the high degree of permissiveness or flexibility with which the cultural norms of the society are observed.

Sinhalese Personality. Both the California Test of Personality and the Rorschach show the Sinhalese children to have worked out an adjustment to deep-seated feelings of rejection and insecurity by means of excessive caution and withdrawal from warm interpersonal contacts. The insecurity of the children studied was interpreted as the result of the parental withdrawal coupled with the absence of alternative emotional supports deriving from the loose structuring of Sinhalese society. These characteristics are sufficiently different from the American children used for comparison, and are widely enough distributed among the Sinhalese children sampled to lend support to the concepts of basic personality and national character.

Urbanization and Child Rearing. Urbanization seems to have had the effect of providing for a more closely integrated pattern of family life than has been the case with traditional Sinhalese social organization. One aspect of this is the tendency of the urban children studied to have

experienced a less permissive pattern of parental care. However, the differences observed are not large.

Residence, Status, and Personality. Both urban residence and high socioeconomic status are associated with high intelligence test scores. No difference in over-all adjustment between residence or socioeconomic status groups was found. But the mode of adjustment characteristic of these groups tends to vary in a manner consistent with closer integration of the urban families and the achievement demands of the higher socioeconomic status groups.

Child Training and Personality. No relationship was found between infant feeding or elimination training practices and personality. Punitiveness of discipline is related to constriction, and over-all adjustment is highest among the children studied for those whose disciplinary experience was neither the most lax nor the most severe. The results of tests of association between parent-child closeness of interaction and personality are unclear. Despite their lack of realism, parental educational achievement demands were found to be associated with children whose personality was relatively more secure, and capable of warm interpersonal relations.

Culture, Personality, and Methodology. The descriptive materials on Sinhalese personality are consistent with expectations based on generalizations concerning the loose structuring of Sinhalese society and the institutionalized pattern of parental withdrawal after infancy. Although based on the same data, no such well-integrated account resulted from the correlational phases of the study. The contrast between the results from the correlational and descriptive phases of the study raised important questions about the validity of the usual methodology in the study of culture and personality. 239 pages. \$3.10. Mic 56-3550

## SOCIOLOGY

### SOCIOLOGY, GENERAL

#### POPULATION PROBLEMS AND POLICIES IN PUERTO RICO, INDIA, AND JAPAN

(Publication No. 18,072)

Robert Harold Amundson, Ph.D.  
University of Notre Dame, 1956

Many areas of the world today are labeled "danger spots" as a result of rapid growth by means of natural increase. This study deals with three such areas -- Puerto Rico, India, and Japan. For the purposes of this research the writer has described these three countries as "areas of population pressure" because they are characterized by low levels of living and social systems conducive to high fertility.

The purposes of this research are: 1) To describe and compare the problem of rapid growth in Puerto Rico, India, and Japan; 2) To describe and evaluate the methods of population control fostered by recent programs or poli-

cies; 3) To consider the practical and ethical aspects of these programs or policies.

Most demographers and sociologists now advocate some method of population control for Puerto Rico, India, and Japan in order to check or restrict population increase. The writer has divided the various methods of population control into two types, direct (rhythm, late marriage, sterilization, abortion, and artificial contraception), and indirect (industrialization, urbanization, education, emigration, and agricultural and economic development programs).

Analysis of the problem of population pressure in the individual countries follows a division into demographic, socio-economic, socio-cultural, and social-psychological categories. A comparative analysis of the problems in these three areas reveals certain similarities which contribute to varying degrees of intensity of population pressure in the individual countries.

Thus far, results of the direct policies of population control in Puerto Rico (sterilization and artificial contraception), India (rhythm and late marriage), and Japan

(abortion, artificial contraception, and sterilization) indicate that the "demographic gap" between high birth rates and declining death rates shows no immediate signs of closure. It would appear that the low fertility ideal preferred by more than 70 percent of the respondents in the many attitude surveys conducted in each of these countries is still opposed strongly by high fertility conditions. The rhythm project in India, however, does show considerable promise as an effective and accepted method of curtailing population growth in that area.

Indirect policies of population control have thus far been more effective in Puerto Rico than in either Japan or India. This is partly a result of the success of the industrialization and economic development programs on the island and the favorable emigration outlets available to Puerto Ricans as United States citizens. Trade restrictions and immigration barriers against both Japanese and Indians have combined to increase population pressure in these two areas.

#### Conclusions:

Indirect methods of population control will continue to reduce population pressure in Puerto Rico if emigration rates remain at present levels. If an economic recession on the mainland results in a reverse flow of migrants back to Puerto Rico, a suggested rhythm project based on the experience of the Indian pilot studies may prove effective in reducing population pressure on the island.

Despite the large numbers of legal abortions in Japan, direct methods of population control have proved ineffective in reducing population pressure there. Removal of restrictions on trade and a lowering of immigration barriers would seem to be the most effective methods of both controlling population growth and keeping Japan within the orbit of the free world.

Although the indirect methods do not appear to provide any immediate solution to population pressure in India, full support for the objectives of the First and Second Five Year Plans and extension of the rhythm project into other areas of India represent, in the opinion of this writer, the most effective approach in controlling population increase in that country.

435 pages. \$5.55. Mic 56-3551

#### A STUDY OF SELECTED ASPECTS OF JAPANESE SOCIAL STRATIFICATION: CLASS DIFFERENCES IN VALUES AND LEVELS OF ASPIRATION

(Publication No. 19,232)

Wendell Dean Baker, Ph.D.  
Columbia University, 1956

A Study of values and mobility aspirations in post-war Japan replicating a study in the United States by Herbert H. Hyman entitled "The Value Systems of Different Classes". Japanese public opinion data collected by the National Public Opinion Research Institute in 1952-53 are analyzed with three basic problems in mind:

(1) Do Japanese low status persons tend to devalue the high prestige goals of their culture as do American low status persons?

(2) Do lower class Japanese tend to reject certain

critical goals instrumental to upward mobility such as formal education, as do lower class Americans?

(3) Is there a general awareness among lower class Japanese that their ascent into high status positions in their society is not likely, as in the United States?

Questions such as "What is your goal in life?", "How far do you think your son (daughter) should go in school?" and "Do you think that things are going to get better or worse from now on?" are cross-tabulated by three indices of socio-economic status:

- (a) educational level of respondent
- (b) occupation of respondent, and
- (c) interviewer rating of social class.

It is found that class differences in aspiration for primary and instrumental goals are greater in Japan than in the United States by all indices of class and index question of mobility aspiration. Even when controlled for age and sex, class differences in Japan are equal to or greater than the differences reported by Hyman for American samples. Although no definitive answer could be given regarding the awareness of probable non-mobility among Japanese low-status groups, several questions were analyzed which suggested a general low level of optimism. In a final chapter survey data are presented to show the isolation from information media, the withdrawal from community life, and general apathy of the Japanese "underdog".

The results of two subsidiary methodological inquiries are also presented concerning the comparative ranking of ninety Japanese and American occupations and a test of coder reliability using ten Japanese "judges". These studies indicated a fairly high degree of reliability in coding Japanese occupations and considerable similarity in the prestige associated with identical occupations in the United States and Japan.

120 pages. \$1.50. Mic 56-3552

#### ALIENATION AND POLITICAL APATHY

(Publication No. 18,784)

Dwight Gantz Dean, Ph.D.  
The Ohio State University, 1956

The originally Marxian conception of "alienation" plays an increasingly significant role in modern sociological analysis. However, the concept is ambiguous, and rarely has it been empirically applied. The aims of the study were: (1) to collate the literature on Alienation and define it more precisely; (2) to develop scales to measure what we see as three components of Alienation--namely, Powerlessness, Normlessness, and Social Isolation; and (3) to explore the hypothesis that political apathy is a function of Alienation when social class and other relevant variables are controlled.

Scales were constructed to measure the three components of Alienation, and these were combined to yield a total Alienation score. Items included in the three scales were retained only when they were consensually rated by independent judges as relevant to the sub-scale under consideration. Intercorrelations among the three component

scales ranged from .41 to .67. Scales were also constructed to measure three aspects of Political Apathy: Interest, Information, and Influence. The Information scale was eliminated because of unsatisfactory reliability. The Interest and Influence scales were combined to yield a Behavior Apathy score. An independent Voting Apathy score was assigned respondents in inverse ratio to their actual voting record over a six-year period. Intercorrelations among the four Political Apathy scales ranged from .37 to .57.

Four wards of Greater Columbus with approximately equal voting ratios but varying economic status were selected for sampling. Precincts and individuals were chosen by random sampling within wards. Of 1,108 questionnaires presumably received, 412 were returned, of which 384 were used. When compared with the general ward population (1950 census), our respondents were significantly higher in both income and educational level. Respondents had a significantly lower (i.e., "better") Voting Apathy score than the non-respondents of the sample.

The correlation of total Alienation with Interest Apathy was .15 (significant at the .01 level); with Influence Apathy, .16; with Behavior Apathy, .17; and with Voting Apathy, .07. The component scores on Powerlessness, Normlessness, and Social Isolation correlated with the various indices of Political Apathy at about the same magnitude.

The total Alienation score (as well as each component) had a low but statistically significant correlation (-.10 to -.24) with the socioeconomic variables of occupational prestige, community size (during childhood), education, and income, and a positive correlation with age. When these socioeconomic variables were controlled by partial correlation, there was little or no change in the correlations between the various Alienation measures and the four categories of Political Apathy. Thus, while many of the correlations obtained were statistically significant, the uniformly low order of these relationships permits little prediction of Political Apathy from the Alienation scales.

The research design included two wards of very similar socioeconomic background, for comparative purposes. There were no significant differences between their mean scores on the Alienation or the Political Apathy scales. Of 16 Alienation-Political Apathy correlations compared, only one differed enough to be statistically significant.

These results raised the basic question of whether Alienation or its components can profitably be viewed (as it is in many contemporary sociological works) as a generic trait, or whether it is more properly seen as a situationally relative quality of modern society.

161 pages. \$2.15. Mic 56-3553

#### AN INDEX OF RELIGIOUS GROUP ACTION

(Publication No. 17,922)

John Steve Holik, Ph.D.  
University of Missouri, 1956

Supervisor: Dr. C. E. Lively

This study was undertaken as an attempt to produce an index which might meet the often expressed desire for a

measuring instrument which would reflect a rural church as a functioning totality. Since 1900 social scientists and interested students of the rural church have used numerous single attributes of a church to compare the functioning of a church with other churches. None of these previous measuring instruments seemed to be very satisfactory for comparing churches as functioning total organizations. The opportunity to devise a measuring instrument of a church as a functioning totality presented itself when the Department of Rural Sociology at the University of Missouri undertook a study of the churches in Rural Missouri. This study was conducted as a cooperative research project by the Department of Rural Sociology of the University of Missouri, with the Rockefeller Foundation and the Bible College of Missouri as cooperating agencies.

The development of the Index of Religious Group Action was preceded by a review of the available literature on previous studies in which statistical measures were used to compare churches. The review of the literature showed that there is considerable variation among researchers as to what certain characteristics of a church reflect as well as how a church should be measured. In order to test the usefulness of these single attributes as a measure of churches, as many of these attributes as the data permitted were subjected to correlational analysis to discover how they were related to each other. Since none of the quantifiable characteristics of rural churches was related highly enough to each other for predictive purposes, the search for a single factor measure of church functioning was dropped.

Efforts were concentrated upon exploring the manner in which different attributes of churches in combination reflect the total operational organization of a church. It was discovered that the seven variables: size of group, total expenditures, number of Sunday's in a month worship services are held, religious education activities, recreation activities, social service activities and pastoral leadership constituted an index continuum which reflected to a high degree the variations in the total functioning of 418 churches of the 505 random sample churches. The factor analysis revealed that this index left a negligible amount of unexplained variation due to other factors. In order to be able to score all of the 505 random sample rural Missouri churches three factors: size of group, number of Sundays per month worship services were held, and religious education activities were selected by factor analysis as a three item index of church functioning. The coefficient of correlation between the seven item index and the three item index was 0.937 therefore the three item index was used as the measure of a church as a functioning totality. This measure was called, "An index of religious group action."

The validity of the index of religious group action was tested by evaluating the capacity of the index to differentiate between categories of churches in previously used classification schemes. The following classifications were used for testing the validity of the index.

1. Open country, small village, and large village churches.
2. Church-type and sect-type groups.
3. Churches with less than 50 members, churches with 50 to 99 members, and churches having 100 or more members.

4. Churches having quarter-time, half-time, and full-time worship services.

5. Declining, stationary, and growing churches.

After establishing the validity of the index the relation between church functioning and certain environmental factors was explored. The most significant result of this exploratory work was the finding that social area differences in church functioning could be explained by the distribution of different religious bodies. The index of religious group action was found to be correlated with the level of living index, membership-population ratio, and soil types.

The index of religious group action was successfully applied to a selected group of rural churches and a sample of small city churches in Missouri. The application of the index to these samples of churches means that the index can be used to measure churches other than the original sample of churches for which the index was constructed.

175 pages. \$2.30. Mic 56-3554

**INTERPERSONAL RELATIONS AND MASS COMMUNICATIONS: STUDIES IN THE FLOW OF INFLUENCE**

(Publication No. 19,246)

Elihu Katz, Ph.D.  
Columbia University, 1956

The starting point for this essay is the discovery, in recent years, of the relevance of interpersonal relations for the flow of mass communications. The introductory section singles out a number of the ways in which an individual's relatedness to others seems to have bearing on his response to influences stemming from the mass media.

Given that interpersonal relations are relevant in these ways, it follows that small group research ought to have something to teach mass communications research. Accordingly, publications in the field of small group research were reviewed with the mass communications perspective in mind.

Two aspects of small groups seem directly pertinent. The first treats the role of interpersonal processes in the formation, maintenance and change of individual opinions, attitudes and actions. The second treats the patterns of interpersonal communication in small groups. In reviewing studies in the latter area, particular emphasis is given to research on leadership and on the communications role of the leader, since the notion of "opinion leadership" in mass communications studies played such an essential part in the initial design of the present inquiry.

But the study of small groups, it is pointed out, is essentially a "hothouse" affair where the group is intentionally cut off from its environment. Given an interest in the flow of communication, it is obvious that it is not enough to take account only of what goes on within a group; it is essential also to ask about the connections that link groups to their environments. Noting this, the literature was searched for a field of research which takes explicit account of interacting individuals on the one hand, and influences stemming from "the world outside" the group

on the other. That branch of rural sociology which treats the diffusion and acceptance of new farm practices is such a field. Here is an island of communications research deriving from a sociological tradition which has taken continual account of the fact that "farmers talk to other farmers" and that such interaction has consequences for the response of individuals and groups to influences stemming from the county agent, farm media, mass media and the like.

Following the review of studies on the diffusion of new farm practices, an analysis is undertaken of the similarities and differences between (1) a study of the diffusion of hybrid seed corn among farmers, deriving from the diffusion studies of rural sociology, and (2) a study of the diffusion of a new drug among doctors, deriving from the tradition of research in mass communications.

The latter study, it is then pointed out, is the most recent study in a continuing series of studies. The first in the series, the 1940 voting study reported by Lazarsfeld, Berelson and Gaudet, contributed the notion of the "two step flow of communication"--the hypothesis which states that mass media influences flow indirectly, from the media to "opinion leaders" and from these influentials to others with whom they are in contact. Continuing in this tradition, Merton found that leadership was limited to "spheres of influence" and that a leader in one realm may have little influence in another. The Decatur study then found that personal influence is generally more effective in the making of everyday decisions in marketing, fashions, etc., than are influences stemming from the mass media. It was further found that each type of leader--fashion leaders, for example--are not only more exposed to the media than non-leaders but they are more exposed to the media appropriate to their sphere of influence. The Elmira study of the 1948 presidential election contributed some findings concerning the way in which members of small groups influence each other's voting decisions. Finally, the above-mentioned study of the adoption of a new drug is reported and its new approach to "survey sociometry" described in detail. The continuity between each of these studies and its forebears is the theme of this analysis.

A summary chapter reviewing the convergences among the several different bodies of theory and research discussed in the text concludes the essay.

307 pages. \$3.95. Mic 56-3555

**THE EFFECTS OF LEADERSHIP CLIMATE ON THE NONDUTY BEHAVIOR OF ARMY TRAINEES**

(Publication No. 19,256)

Hanan Charles Selvin, Ph.D.  
Columbia University, 1956

A central concern of research on leadership is the relation between a leader's actions and the behavior of his followers in their assigned tasks. Often, however, influence over the followers is exerted by more than one leader, and this influence may extend beyond the formal activities of the group. Both these conditions obtained in the seven Army training companies with which this study deals. Instead of considering only one leader it was necessary to devise methods for measuring the "leadership

"climate" produced by all the commissioned and noncommissioned officers in each company. These leadership climates were found to have marked effects on the behavior of the trainees when they were not engaged in their military duties.

In each company the trainees rated each leader on a fifteen-item pencil-and-paper questionnaire. From these ratings the leadership climate of the company--defined, in effect, as the way an "average trainee" perceives his leaders--was computed by means of an application of factor analysis. The three principal climates are the Persuasive, in which the trainees admire and do not fear their leaders; the Arbitrary, in which there is fear and no admiration; and the Weak, with little of either feeling.

A second questionnaire elicited data on behavior during basic training and on changes in behavior from civilian life for some twenty activities, ranging from drinking or fighting to reading or engaging in a hobby. In general, the rates of these activities during basic training were highest in the Arbitrary climate and lowest in the Persuasive. Two interacting causes are apparently at work here: (1) the Arbitrary climate generates the highest level of tension and the Persuasive climate the lowest, and (2) the Arbitrary climate most sharply restricts alternative channels of tension release, so that the accumulated frustrations of basic training are more frequently worked off in leisure-time activities.

Within companies having the same leadership climate, differences in the trainees' characteristics also affect their behavior. Consistent differences in leisure-time pursuits are found between the younger trainees and the older, the single and the married, and the more-educated and the less-educated.

The joint effects of leadership climate and the trainees' characteristics are considered in two types of "contextual analysis." The first deals with the ways in which the correlations between trainees' characteristics and behavior vary from one leadership climate to another; for example, in the persuasive climate the single trainees are more likely to go AWOL for a few hours than are their married comrades, while in the arbitrary climate the relationship is just the reverse. The second type of contextual analysis identifies those groups of trainees whose behavior is most susceptible to differences in leadership; these are the older and the married trainees and those who did not graduate from high school.

In large part the data on changes in behavior from civilian life complement the data on behavior during basic training. They also make it possible to discover the particular combinations of trainees' characteristics and leadership climate that produce the greatest changes in non-duty behavior among new soldiers.

One methodological contribution of this study has been the development of procedures for testing the significance of correlations or differences in survey data. Every substantive finding has been tested by noting the consistency with which similar results are obtained in a series of independent comparisons. This criterion of consistency provides a valid test of significance in survey research, where the usual statistical tests may be misleading.

309 pages. \$4.00. Mic 56-3556

#### MOBILITY ORIENTATION AND STRATIFICATION: A STUDY OF ONE THOUSAND NINTH GRADERS

(Publication No. 19,257)

Richard Manning Stephenson, Ph.D.  
Columbia University, 1956

In order to determine the extent to which students distinguish aspirations from plans in stating occupational choice and the degree to which position on a scale based upon father's occupation differentiates such choice, an anonymous questionnaire was submitted to 1,000 ninth grade students in four, semi-industrial, urban communities in New Jersey in 1950. The questionnaire was designed to permit the student to state both an occupational plan and an occupational aspiration. Additional information was obtained on the youths' educational plans and choice of high school curriculum, sex and race, and parents' education and occupation.

Fathers' occupations and the occupational plans and aspirations of the students were classified in accordance with the Alba Edwards scale so that comparisons of plans and aspirations at occupational group levels might be made. These data demonstrated that students do distinguish between plans and aspirations, with aspirations registering dominantly in the professional and owner-manager roles and plans spreading out more evenly through the occupational hierarchy. The students' class positions differentiated both plans and aspirations. However, while there was a relatively consistent pattern of high occupational aspiration among all youths, their plans tended to conform more nearly to their position in the stratification system.

Both curriculum choices and educational plans of the students conformed to their occupational plans and class positions. These relationships were repeated when students were tabulated by sex and race. Males were more uncertain about their plans than females but tended to spread their occupational plans over a wider range of occupational groups. In comparison with white students, Negroes expressed lower occupational plans at each group level, but maintained similar high occupational aspirations. The students' specific occupational choices tended to reflect the pattern of group choice. Direct occupational inheritance was found dominantly among sons of farmers and business owners, and lower class students tended to seek special avenues of mobility in occupations avoided by the uppers. Among students whose plans and aspirations matched, orientations were considerably higher than the total sample.

The mothers' occupations showed the same influence upon students' choices as the fathers'. However, there was a tendency for the occupational plans of lower class students whose parents both work to be higher than those whose fathers alone worked, particularly where the mothers' occupations were higher than the fathers'. The parents' education was positively correlated with the educational plans of their children. At the same time, at any Group level, students whose father had college training were more likely to plan for college than those whose father had only high school or grammar school education. The same was true of mother's education.

These relationships have consequences for both method and theory. Methodologically, they suggest the necessity of distinguishing plans and aspirations in studies concerning

students' vocational orientations. Theoretically, they suggest that mobility orientation as measured by occupational choice is two dimensional, embracing both an aspiration and a plan. The pattern is one in which mobility aspirations are more or less uniformly high, but plans tend to conform to position in the stratification system. From the point of view of mobility analysis, this suggests a potential of frustration and dissatisfaction on the part of the lower class youths whose aspirations are unmet by their educational and occupational plans.

225 pages. \$2.95. Mic 56-3557

## SOCIOLOGY, FAMILY

### A STUDY OF SOME ASPECTS OF MARITAL BEHAVIOR AS RELATED TO RELIGIOUS CONTROL

(Publication No. 18,673)

Jacob Anthony Samenfink, Ed.D.  
The Florida State University, 1956

The present study grew from the writer's observations of certain discrepancies between the teachings of the Roman Catholic Church regarding marital behavior and the actual behavior of some individuals who consider themselves to be "good" Roman Catholics. The major focal points of the study were the use of contraception and conceptions of marriage and marital roles. The major concern of the study was to ascertain the extent to which the Roman Catholic young married people in the Acadian subculture in southwestern Louisiana tended to have rejected the position of the Roman Catholic Church regarding contraception and marriage and marital roles and to have accepted a more secular position, for the purposes of this study, that of Protestantism.

Three major hypotheses were tested:

(1) Roman Catholic young married people depart from the dogma of their Church in matters regarding the practice of contraception.

(2) Roman Catholic young married people depart from the dogma of their Church in their concepts of marriage and marital roles.

(3) There is similarity between Roman Catholic and Protestant young married people in their acceptance of contraception and in their concepts of marriage and marital roles.

These hypotheses were tested by means of a schedule which included a series of statements accepted by a member of the Roman Catholic hierarchy as accurately representing the dogma and contra-dogma of the Church. This schedule was administered to one hundred Roman Catholic young married people in southwestern Louisiana and one hundred Protestant young married people in the northeastern part of the United States who were matched for certain social and economic characteristics. The "t" test was used to determine the significance of the difference between the responses of the Roman Catholics and Protestants.

The findings indicated that the Roman Catholic young married people were not entirely accepting of the position

of their Church regarding these concepts of contraception and marriage and marital roles. Their rejection of the dictates of the Church regarding contraception was important evidence of this fact. When contrasted with findings for the Protestant group, however, the Roman Catholic respondents were less accepting of the statements representing the secular position, with the exception of the statements dealing with equalitarianism in family living. A significant difference at the one percent level (or greater) was found between the responses of the Roman Catholics and Protestants. In regard to the practices of contraception the Roman Catholic young married people were again not entirely accepting of the position of their Church. The use of contraception in pre-marital and marital sexual activities, and indulgence in pre-marital sexual relations, were of sufficient frequency to indicate a departure from Church-sanctioned patterns of behavior. The Roman Catholic respondents were not as "liberal" in this area, however, as were the Protestants.

The implications from this study were:

(1) The Roman Catholic Church has failed to communicate successfully its teachings regarding contraception and marriage and marital roles to these adherents.

(2) The Roman Catholic Church in southwestern Louisiana apparently has been unsuccessful in motivating its young married people to adopt Church-sanctioned marital practices, rather than those of the prevailing secular society.

(3) There is an apparent need for comprehensive family life programs at the diocesan and parish levels. These programs would include marriage and family counseling centers and "conception clinics."

106 pages. \$1.50. Mic 56-3558

## BEHAVIORAL FACTORS AFFECTING FERTILITY EXPECTATION: INTRODUCTION TO BEHAVIORAL DEMOGRAPHY

(Publication No. 17,493)

George Kazunari Tokuhata, Ph.D.  
State University of Iowa, 1956

Chairman: Professor Harold W. Saunders

This is an inquiry into the behavioral factors affecting human fertility expectations within a definite theoretical orientation, identified as the "behavioral frame of reference". The study was designed as an introduction to, and example of, Behavioral Demography, which is considered to be a branch of the science of demography as well as that of general social science. Behavioral Demography as a subdiscipline of the behavioral sciences deals exclusively with those behavioral factors which are qualitative, yet quantifiable. The "behavioral frame of reference" is to be understood as an analytical perspective through which objective observation, interpretation, and generalization of a subjective, but measurable, attribute is to be made. Thus, human fertility was treated and analyzed as a perceptual or behavioral property, that is, fertility expectation. The author has attempted to reconcile or consolidate the two suborientations, i.e., social interaction theorem and social action theorem, which are characteristic

of recent sociological inquiries, into a systematic theoretical orientation. The concept "fertility expectation" was defined and analyzed in two different, but related, sub-concepts, that is, "ideal expectation" and "effective expectation". The balance between these sub-concepts is termed "fertility expectation differential" which, in turn, was postulated as explainable in terms of the property of "dysmotivation", or negative motivation operative in the process of adjusting the ideal mode into the effective mode of expectation, or accommodating one's ideal conception to perceived social reality. Those behavioral factors which are assumed to be inducive to the formation of fertility expectations are treated as the Inducive Factors. These factors are: (1) Self-Collectivity Oriented Personality; (2) Emotional Identification with Family of Orientation; (3) Rational Definition of Family; (4) Ideal Identification of Siblings; and (5) Personal Attitude Toward Children. Those behavioral factors which are assumed to be deterrent to fertility expectations, or which produce dysmotivation, are treated as Deterrent Factors. These factors are: (1) Endogenous Economic Expectation; (2) Exogenous Security Expectation; (3) Personal Deprivation; (4) Occupational Deprivation; and (5) Physical Deprivation. In the light of the general theoretical orientation, a series of hypotheses was deduced from the original problems or questions. The concept "fertility expectation" was treated as the dependent variable, while both Inducive and Deterrent Factors were treated as independent variables respectively in the general analytical construct.

The general problem was designed to be answered from three different, and independent, approaches, which were in turn identified as three different mathematical methods of arriving at the measure of effective fertility expectation. These analytical models were actually substantiated through a series of statistical manipulations of the data collected from the sample. Three of the five Inducive Factors were measured by the Scalogram technique and a satisfactory scalability was established in the light of Guttman's criteria. Statistical analyses (both qualitative and quantitative) revealed that all of the five Inducive Factors are extremely significant variables in explaining the variations in fertility expectations in both ideal and effective modes. On the other hand, what was significantly associated with the magnitude of the expectation differential appeared to be those Deterrent Factors which are essentially "economic" in nature. In short, the present research endeavor aimed at investigation of the logical and empirical continuities between family of orientation and that of procreation as they are related to the covert or anticipatory aspect of fertility behavior.

167 pages. \$2.20. Mic 56-3559

## SOCIOLOGY, PUBLIC WELFARE

### THE EFFECTS OF LENGTH OF INCARCERATION UPON PAROLE ADJUSTMENT AND ESTIMATION OF OPTIMUM SENTENCE: WASHINGTON STATE CORRECTIONAL INSTITUTIONS

(Publication No. 18,497)

Donald Lee Garrity, Ph.D.  
University of Washington, 1956

This study is an investigation of the effects of length of incarceration upon parole adjustment and the estimation of optimum sentence. The research involved investigating the effects of length of incarceration upon parole adjustment which were suggested by the concepts of prisonization, criminal maturation, social disorganization, personal disorganization, and Schrag's criminal typology. Secondly, it involved constructing and testing an instrument to estimate the optimum period of incarceration for specified types of persons.

The data for this research were gathered from the files of the Board of Prison Terms and Paroles. Information was recorded for all persons who were considered by the parole board at the Washington State Reformatory between February, 1951 and June, 1952, and June, 1952 and June, 1954. Information was recorded for all parole candidates at the Washington State Penitentiary between March, 1951 and June, 1952, and June, 1952 and June, 1953. The persons appearing in the first time period were used as a construction population and the second time period group as a test population. The construction populations included 704 cases from the reformatory and 562 cases from the penitentiary. The test populations included 563 cases from the reformatory and 505 cases from the penitentiary.

The major findings of this study are the following:

a. When the populations were classified on variables which were suggested as important by the concepts of prisonization and criminal maturation, the hypothesized trends in violation rates which were suggested by these same concepts were not observed. The investigation revealed that the hypothesized effects of these processes on post-release adjustment fitted most closely the patterns of the habitual property offender. The findings suggested that these concepts need to be re-examined empirically.

b. Examination of the violation rates over time served in the institution when the populations were classified by the degree of social disorganization in their background and the type and degree of personal disorganization revealed that the hypothesized trends which were deduced from these concepts were not supported by the data. This investigation revealed that time served in the institution has little effect upon the person with little social and personal disorganization. The probability of successful adjustment on parole increases as time served increases for the persons with considerable social and personal disorganization.

c. The populations were classified using Schrag's criminal typology. The effects of length of incarceration which Schrag hypothesized were examined and it was found that the data supported each of these hypotheses.

d. Schrag's criminal typology was used to construct a table which was used to estimate the optimum length of incarceration for each type of offender. These estimates

which were made were tested on new populations and found to be correct in approximately 60 per cent of the types. These results suggest that estimating optimum sentence at time of incarceration can be done with considerable accuracy after additional research has been done.

Attention was given to research in correction, policy

and administrative decision making, and the area of parole prediction. The research findings suggested a number of important problems which need examination to answer important questions for correctional officials and criminologists.

283 pages. \$3.65. Mic 56-3560

## S P E E C H

### S P E E C H, T H E A T E R

#### A STUDY OF NUMBER-TELLING METHODS IN COMMUNICATION

(Publication No. 18,770)

Sol Adler, Ph.D.  
The Ohio State University, 1956

Different methods of telling numbers containing one, two, three, and four digits were investigated in relation to intelligibility values for American listeners. Speakers were equally distributed among male and female representatives of the major American dialects (General American, Eastern, and Southern) and foreign nationals of English, French, and Spanish origin.

When Americans transmitted to Americans during adverse listening conditions, the following pronunciations were statistically superior: (0) ze-ro, (1) uh-wun, (3) th-r-ee, (6) six, sixer, suh-six, (7) sev-ven. Those pronunciations which showed no differences were (2) too, tuh-hoo, tuh-too, (4) four, fo-wer, ふuh-four, (5) fi-i-iv, five, fi-yiv, fife, ふuh-five, fiver, (8) ait, aiter, a-ait, (9) nine, ni-yen, nyner, nuh-nine.

When foreigners transmitted to Americans during adverse listening conditions, the following pronunciations were statistically superior: (0) ze-ro, zero, (2) too, tuh-too, (4) four, (5) fi-i-iv, five, (6) six, sixer, (8) ait, a-ait. Those pronunciations which showed no differences were (1) wun, wuner, uh-wun, wuh-wun, (3) th-r-ee, thuh-ree, three, tree, thuh-three, (7) sev-ven, seven, suh-seven, (9) nine, ni-yen, nyner, nuh-nine.

In numbers containing two digits, single digit-telling (one-two) is more effective than the group digit-telling (twelve) method.

In numbers containing three digits, single digit-telling (one-two-three) is statistically superior to group digit-telling (one-twenty three, twelve-three, and one hundred twenty three) methods.<sup>1</sup>

In numbers containing four digits, single digit-telling is statistically superior to group digit-telling (twelve-thirty four, twelve hundred thirty four, one thousand two hundred thirty four) and combination digit-telling (one-two-thirty four, twelve-three-four) methods.

Per cent intelligibility values of the various speakers in respect to nationality, dialect, and sex are discussed within the limits imposed by the study.

112 pages. \$1.50. Mic 56-3561

1. Because of the use of the hyphen to signify grouping, the ordinary rules for hyphenating numbers have not been adhered to.

#### THE RELATIONSHIP BETWEEN VOCAL CHARACTERISTICS IN ORAL READING AND THE RELATIVE INFORMATION OF SELECTED PHRASES

(Publication No. 18,771)

Mary Boyle Alluisi, Ph.D.  
The Ohio State University, 1956

Voice recordings of a minute in duration were made by 50 randomly selected students from elementary classes in speech and by two trained speakers. The recordings were then presented to ten judges, who rated the speakers. The two highest- and the two lowest-rated male readers were selected to make recordings of two reading passages. These two passages differed in difficulty level as measured with a readability formula.

From each of the two selections, a word sample of about 10 per cent was graphically portrayed by a visible speech technique, and these representations were used in making measurements of key, range, and duration patterns. The sound intensity levels of the word samples were also measured by means of a power-level recorder; measurements were made of average syllabic speech power and of the total speech power per syllable in all the sampled phrases.

In addition, an index of information was reported for each of the phrases. The index of information for a phrase was the average number of incorrect letter predictions per syllable made by ten people who predicted the phrases letter by letter. This index was assumed to be directly proportional to the relative information. Finally, the measures of key, range, duration, and speech power were related to the relative information of the various phrases by statistical techniques.

The mean index of information for the phrases sampled from the difficult passage was significantly greater than the mean of the phrases from the easy passage. This suggests that readability as measured by a readability formula may be directly related to the relative information as measured with a letter-prediction technique.

Coefficients of correlation were obtained between the

index of information and the various measures of vocal characteristics. These indicated that there is probably a negative relation between the total frequency range used in orally reading a phrase and the relative information of the phrase. Furthermore, there is probably a positive relation between the average syllabic speech power used in orally reading a phrase and the relative information of the phrase, as well as between the total speech power per syllable and the relative information.

All four Ss showed greater variability in the average frequency range used in the phrases of the easy passage than in those of the difficult passage. The two low-rated Ss had significantly greater variances of duration per syllable in the phrases of the easy passage than in those of the difficult passage.

One of the two low-rated readers showed significantly lower variances than the other Ss in both passages with the measures of total frequency range, average frequency range, average syllabic speech power, and total speech power per syllable. The variability of the other low-rated reader was about equal to that of the two high-rated readers. This implies that variability, *per se*, does not define a good oral reader.

Finally, the two measures of speech power were found to be positively correlated ( $r = \text{about } + .50$ ). A check of the reliability of measuring the various vocal characteristics from the graphic portrayals indicated that the measures could be made reliably; the lowest reliability coefficient obtained was  $.90$ . 86 pages. \$1.50. Mic 56-3562

#### RELATIONSHIPS AMONG TESTS OF INTELLIGIBILITY, WORD-RECEPTION, AND OTHER MEASURES OF SYMBOLIC FORMULATION

(Publication No. 18,795)

Richard Hendricks, Ph.D.  
The Ohio State University, 1956

Steadily increasing knowledge of the functioning of the human cerebral cortex invites investigation and hypotheses relating to the various aspects of the language function in human beings. Holistic theories of cerebral organization support a concept of a central integrating factor upon which specific language skills depend. It was hypothesized in this investigation that the centralized nature of the language function would manifest itself in correlations between measures of specific skills in speech and language.

Two premises basic to the selection of the problem were: (1) that pedagogic and therapeutic procedures in language training will be improved when the relationships between speech and other language skills are more clearly defined, and (2) that the definition of these relationships will be facilitated by the development of instruments for the measurement of abilities and aptitudes for producing and receiving speech.

Four measures were selected for investigation because of their relationship to different aspects of speech ability or disability. These measures were administered to 161 subjects, and the results were compared with other measurements of other abilities of the subjects.

One hundred sixty-one college students served as experimental subjects. They were administered tests of

(a) motor perseveration, (b) speech attitudes, (c) speech intelligibility, and (d) auditory word-reception. Subjects' responses on these tests were compared with the scores they earned on the following college entrance tests: (1) the American Council on Education Psychological Examination, (2) the Cooperative English Test A, (3) the Cooperative English Test of Reading, (4) the University of Maryland Algebra Test.

Product-moment correlations among the college entrance tests were significantly positive, the higher correlations occurring in two groups, one relating to quantitative mathematical skills and the other to verbal abilities.

Among the speech-related measures the only positive correlation found was that between speech intelligibility and word-reception, a relationship which proved to be a function of group testing procedures and was, therefore, spurious.

Low positive correlations were found between word-reception scores and the subjects' scores on the English grammar test and the test of reading speed. The Speech Attitude Scale and the test of motor perseveration were not significantly related to any other measurements used.

The Multiple-Choice Intelligibility Tests were found to be reliable testing instruments by item analysis, though the size of the reliability coefficient for the tests was dependent upon methods of assembling the sample (from one test group or more than one).

The hypothesized integration of speech with other aspects of symbolic formulation was not borne out in the results of this study. Need for improvement in procedures was indicated in relation to (a) perseveration testing, (b) intelligibility and word-reception testing, and (c) interpretation of intelligibility and word-reception scores.

60 pages. \$1.50. Mic 56-3563

#### A RECONSTRUCTION OF THEATRICAL AND MUSICAL PRACTICE IN THE PRODUCTION OF ITALIAN OPERA IN THE EIGHTEENTH CENTURY

(Publication No. 18,810)

Theron Reading McClure, Ph.D.  
The Ohio State University, 1956

The productions in the Italian opera houses of the eighteenth century are looked upon today as having been an artificial, nondramatic, and ridiculously overblown form of theatrical activity. Benedetto Marcello's treatise, *Il teatro alla moda* (1720), which described the opera of that period in such a light, is now accepted as the definitive view of the eighteenth-century musical theatre. The present writer, however, using source material equally authoritative, has endeavored to uncover a truer, less biased picture of the operatic scene. The examination of the writings of eighteenth-century workers in the operatic theatre, of the journals of foreign travelers in that day, of reports on modern research among old municipal and theatrical records and inventories, and of modern studies of the baroque arts has made possible a more accurate concept of the values inherent in the eighteenth-century opera than is presented by Marcello's treatise.

The arts and skills which are combined to form opera include poetry, painting and scenography, acting, dancing,

costume design, musical composition, singing, and orchestration. Each of these factors is examined in turn, in an endeavor to evaluate its contribution to the operatic whole. The rather unstable combination of the elements into a single dramatic form, along with an attempt to express therein the spirit of the times (the baroque), resulted, during the eighteenth century, in a musico-dramatic form which, judged by modern standards, may seem rather artificial and eccentric. Some of the artistic elements dominate the others. It appears that one or another of these constituent operatic arts must take the leadership in forming and organizing the whole, in any operatic era. In the eighteenth century, two of them (singing and scene-painting) were found to be the most adaptable and the best suited for the expression of the prevailing baroque spirit, and were given a dominant place in the production.

The mania of eighteenth-century theatrical audiences for the operatic entertainment was matched by the audience's own extravagant social life in the opera house, and was even reflected in the creation of a new bizarre architectural form of theatre. But the seemingly synthetic nature of the operatic activity should not be permitted to conceal the fact that the medium was highly successful in giving expression to the artistic impulses of its age. The baroque appetites for grandeur of environment, elevation of mood, and kaleidoscopically continuous movement into the minute detailing of artistic forms were better satisfied in the all-inclusive operatic medium than in any other art form of the day.

The study concludes that the opera, through the very means so objected to by its critics, namely, the molding of its elements into a highly distorted or off-balance theatrical form, was able to produce the best and most successful artistic medium of the late baroque period.

202 pages. \$2.65. Mic 56-3564

**THE THEATRE IN MEMPHIS, TENNESSEE,  
FROM ITS BEGINNING TO 1859  
(PARTS ONE-FIVE)**

(Publication No. 17,484)

Charles Clifford Ritter, Ph.D.  
State University of Iowa, 1956

Chairman: Professor William R. Reardon

The purposes of this study were to place the early theatre of Memphis, Tennessee, into true perspective within its historical context, and to assess several theatrical stock companies of the city in order that they might be more properly evaluated in comparison to those which existed in other cities and in other periods.

The period from 1829 to 1859 saw the foundation of drama in Memphis. During the first dozen years, and while Memphis was still very much dominated by Mississippi River flatboatmen, dramatic activity was sporadic and profitable only because of its novelistic appeal. In 1829, Sol Smith headed the first professional acting company to visit the small western village. A Thespian Society was organized the following year, and a number of the town's most prominent young gentlemen starred in its productions. Succeeding years saw a number of itinerant

companies come and go. The outstanding playhouse in these first years was the Market Street Theatre, which was little more than a crude shack.

By 1841 Memphis had begun to assume a significant position as a cotton port. From 1841 to 1849, while the city grew in wealth and population, there were two unsuccessful attempts to establish a permanent playhouse--the City Theatre in 1842, and the Second Street Theatre in 1846. Dramatic activity was occasionally challenged by other forms of entertainment at Concert Hall, and later at Hightower Hall.

In 1849 an abandoned Universalist Church was converted into a theatre by a stranded acting company. This theatre was called the Memphis Theatre; it soon failed after a successful beginning. In the midst of general local prosperity, the Memphis Theatre was revitalized in 1851 under the managers James S. Charles and David T. Ash. Charles left the management in 1855; Ash continued as manager of the house until his death in 1858.

In 1856 a move was begun to construct a new theatre in the city, since the rapidly growing community found the old house objectionable because of its diminutive size and ill-favored location. The new playhouse was completed and opened in 1857. It was named Crisp's Gaiety after its manager, William H. Crisp. Memphis thus had its first theatre built expressly for legitimate dramatic purposes.

For the better part of two seasons, Ash and Crisp competed for an affluent Memphis theatre-going audience. In the battle for theatrical success, Crisp was the victor. The old Memphis Theatre did not lose stature as a competitor, however, until after Ash's death in December, 1858. The Gaiety Theatre was left as the only significant legitimate theatre in Memphis.

405 pages. \$5.20. Mic 56-3565

**AN EXPERIMENTAL INVESTIGATION OF CERTAIN  
COMMONLY SUGGESTED TEACHING METHODS FOR  
THE DEVELOPMENT OF CONFIDENCE IN BEGINNING  
STUDENTS OF PUBLIC SPEAKING**

(Publication No. 17,975)

Edward Ray Robinson, Ph.D.  
Indiana University, 1956

Chairman: Raymond G. Smith

The purpose of this study was to determine whether currently used text books for beginning speech courses at the college level contain any consistent pattern of advice for the development of confidence and to test, within the limits of an experimental situation, the relative effectiveness of such suggestions.

A representative list of thirty-four text books published between the years 1915-1954 was surveyed for suggestions relative to the development of confidence. From this survey three general patterns of advice were chosen for experimental testing. They were: (1) "Stress upon Bodily Control;" (2) "Emphasis upon the Message of the Speech," and (3) "Emphasis upon Speech Preparation." Classroom teaching procedures were organized stressing each of the three categories. A fourth teaching method which emphasized (4) "Direct Suggestion" was included in order to test

whether any changes in confidence might result from suggestion rather than from the experimental teaching methods.

The experimental teaching methods were rotated among three instructors. Each instructor taught additional sections wherein the experimental teaching methods were not used.

Since the information was readily available, the effects of such factors as the instructor and the sex of the students on the development of confidence were also investigated.

A modified form of the Gilkinson Personal Report of Confidence as a Speaker<sup>1</sup> was used both before and after training to measure changes in confidence levels.

All subjects in the experiment were from the beginning speech course at Ohio Wesleyan University during the second semester of the 1954 and the first semester of the 1955 academic years. In all, four hundred and thirteen students participated. These were divided into groups as follows: "Bodily Control, 57 subjects; "Message," 44 subjects; "Speech Preparation," 48 subjects; "Suggestion," 52 subjects. Two control groups were used. One group of 74 subjects came from sections taught by instructors who used the experimental teaching methods in other sections. The second control group consisted of 138 students taught by other teachers.

Analysis of variance was used to test the significance of differences in changes of confidence.

Conclusions, based on the subjects and variables used in this particular study, were as follows:

1. Students make statistically significant gains in confidence following a course in public speaking.
2. There are no statistically significant differences in the confidence gained by students taught under methods emphasizing "Bodily Control," "The Message of the Speech," "Speech Preparation," or "Suggestion."
3. The instructor in a beginning public speaking course is not a differentiating factor in the development of confidence.
4. There is a statistically significant difference in the confidence levels reported by male and female students prior to speech training with the female students reporting lower initial confidence levels.
5. The sex of the student is not a differentiating factor in the development of confidence during a period of training in public speaking.
6. Students tend to maintain relatively the same position in class confidence levels following a period of training in public speaking. 150 pages. \$2.00. Mic 56-3566

1. Gilkinson, Howard, "Social Fears as Reported by Students in College Speech Classes," Speech Monographs IX (1942), p. 141-160.

## AN INVESTIGATION OF THE RELATIONSHIP BETWEEN THE LIPREADING ABILITY OF CONGENITALLY DEAF HIGH SCHOOL STUDENTS AND CERTAIN PERSONALITY FACTORS

(Publication No. 18,827)

Anna May Lange Worthington, Ph.D.  
The Ohio State University, 1956

Fifty-one congenitally deaf high school students of normal intelligence at the Wisconsin and Ohio Schools for the Deaf served as experimental subjects for an investigation to determine whether or not relationships existed between lipreading ability and certain personality factors. These factors were (1) level of aspiration in which the reactions of the students to success and failure in a multiple-choice lipreading test were indicated by their estimations of proficiency on similar tasks about to be undertaken, (2) level of aspiration in which the reactions of the students to success and failure on a simple motor task were indicated by estimations of proficiency on similar tasks about to be undertaken, and (3) degree of adjustment as indicated by scores on a sentence-completion test.

The tests used in obtaining scores relative to the personality factors were (1) a motion-picture film of the Multiple-Choice Intelligibility Test: Form A, (2) the Rotter Level of Aspiration Test, and (3) the Rotter Incomplete Sentences Blank, college form. The Ohio State Lipreading Test 410 was used to determine the relative lipreading ability of the students.

In order to determine the relationship between lipreading ability and behavior as indicated by scores on the level-of-aspiration studies, the data were treated by means of correlation and Chi-square techniques; the relationship between the patterns of behavior of the two level-of-aspiration studies, by a Chi-square test; and the relationship between lipreading ability and degree of adjustment as indicated by the sentence completion test, by correlation.

Within the limits of the present study, the following conclusions are drawn.

1. There is no apparent relation between lipreading ability and behavior of a congenitally deaf high school student when he is confronted with a lipreading task.
2. There is no apparent relation between lipreading ability and behavior of a congenitally deaf high school student when he is confronted with a simple motor task.
3. There is a probable relation between the behavior of a congenitally deaf high school student when he is confronted with a lipreading task and his behavior when confronted with a simple motor task.
4. There is no apparent relation between the degree of adjustment of a congenitally deaf high school student and his lipreading ability.

80 pages. \$1.50. Mic 56-3567

## ZOOLOGY

### EFFECT OF ADRENAL STEROIDS ON THE PERMEABILITY OF THE SYNOVIAL MEMBRANE

(Publication No. 19,067)

Kenneth Alfred Aulsebrook, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Roland K. Meyer

Methods for study of synovial permeability in the rat knee joint to sodium-para-amino-hippurate (PAH), I<sup>131</sup>, P<sup>32</sup> and Na<sup>22</sup> are presented. Removal of PAH from the joint as evidenced by urine recoveries is reduced after joint injury with 1 per cent formaldehyde. The reduction develops rapidly and persists for two weeks. Cortisone administered before injury prevents the decrease, but does not when treatment is begun the day after injury. Cortisone does not alter transfer of PAH from "sham injured" joints. Effects of formaldehyde on PAH recoveries are not dependent upon renal mechanisms, nor is the effect of cortisone. Desoxycorticosterone, pregnenolone and progesterone do not affect PAH transfer from "formalin arthritic" joints. Evidence is presented for production of anti-inflammatory substances in large amounts during pregnancy in the rat, as shown by inhibition of the growth of connective tissue around subcutaneously implanted cotton pellets and development of resistance to the effects of intra-articular formaldehyde on PAH transfer from the knee joint. Production of these substances continues at a somewhat lower rate during lactation. Evidence is also presented for the presence of anti-inflammatory substances in extracts of human placentas.

Transfer of I<sup>131</sup>, P<sup>32</sup> and Na<sup>22</sup> from the joint was studied by following removal of these ions from the synovial space by means of a Geiger tube placed over the joint. No effects on transfer appear at 1, 5, or 14 days after joint injury with 1 per cent formaldehyde. Transfer of all 3 ions is below normal 1 day after injury with 5 per cent formaldehyde, essentially normal at 5 days, and increased above normal for P<sup>32</sup> and Na<sup>22</sup> at 14 days. I<sup>131</sup> transfer is only slightly above normal at 14 days. Cortisone generally prevents the transfer changes when treatment is begun before injury, but fails to prevent the increased Na<sup>22</sup> transfer at 14 days when delayed until the day after injury. Desoxycorticosterone sensitizes the synovialis to the inflammatory effects of the irritant, as evidenced by reduced transfer of Na<sup>22</sup> from the joint 1 day after injury with 1 per cent formaldehyde. This effect of desoxycorticosterone is prevented by concomitant cortisone treatment. These steroids do not affect the permeability of "sham injured" joints to I<sup>131</sup>, P<sup>32</sup> or Na<sup>22</sup>. Histological studies of the synovialis in "formalin arthritic" joints with and without corticoid treatment indicate that the intensity of the inflammation is proportional to the concentration of the irritant, and that cortisone suppresses and desoxycorticosterone intensifies the morphological features of the response if present in relatively large amounts at the time of formaldehyde injection. Synovial permeability changes

in "formalin arthritis" are thus generally correlated with microscopic changes in the inflamed joints.

For the purpose of investigating blood flow through the synovial tissues, build-up in the joint of radio-phosphorus given by tail vein injection was studied at 1, 5, and 14 days after both 1 per cent and 5 per cent formaldehyde injury to the synovialis. Comparison of build-up curves with others obtained in "sham-injured" and normal rats indicates that changes in local blood flow are not an important cause of altered transfer from "formalin arthritic" joints.

149 pages. \$2.00. Mic 56-3568

### GLYCOGEN VARIATIONS IN THE DOMESTIC FOWL INFECTED WITH EIMERIA TENELLA

(Publication No. 17,296)

Cleo Lafayette Bentley, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Dr. M. G. Lysenko

In this investigation the glycogen stores in domestic fowl were studied in order to determine some of the factors involved in the utilization and storage of carbohydrates by the host during the course of infection with Eimeria tenella.

The animals used in this study were Single Comb White Leghorns. The determinations of blood sugar were made according to the method of Folin and Wu (1930). Glycogen determinations were made using the anthrone reagent. A modification of the method of Seifter and Dayton (1950) was employed.

Experimental evidence clearly showed a diminution in muscle and liver glycogen during the critical phase of coccidiosis. On day 5 subsequent to infection, liver glycogen showed an 83.6% decrease from that of the uninfected controls. Breast muscle glycogen showed an 80.0% decrease from that of the uninfected controls.

When an injection of a 50% glucose solution was given chickens infected with coccidiosis, the glycogen content of liver tissue increased. On day 5 following infection there was an increase of 272.8 mg. for each 100 grams of tissue.

In two lines of chickens one bred for resistance to coccidiosis and the other for susceptibility to coccidiosis, there was no significant difference in the glycogen content of liver and muscle tissues of uninfected animals. However, on day 5 following infection the glycogen content of the liver of resistant chickens had increased to normal, whereas the glycogen content in susceptible chickens continued to decrease.

A decrease in glycogen in young chickens infected with Eimeria tenella was shown by experimental data. An intravenous injection of glucose during the critical stages of coccidiosis produces an increase in the glycogen depositions within a period of 3.5 hours after injection. The

glycogen contents of tissues of uninfected resistant and susceptible chickens were not significantly different. There was a very important difference on day 5 following infection at which time the glycogen of the resistants returned to a normal level while that of the susceptibles continued to diminish. 61 pages. \$1.50. Mic 56-3569

#### THE RELATIONSHIP BETWEEN THE MAJOR SALIVARY GLANDS AND VARIOUS ENDOCRINE ORGANS

(Publication No. 17,936)

David Bixler, Ph.D.  
Indiana University, 1956

Although the salivary glands have important exocrine functions associated with the digestive processes, numerous recent reports also have suggested that the salivary glands possess an intimate relationship with endocrine organs and even may have endocrine function. The purpose of this thesis was to investigate the possibility of endocrine functions and the relationship between endocrine organs and salivary glands in the albino rat.

The principal method of investigation involved the surgical removal of the major salivary glands from weanling rats and a study of the effects of this removal upon general body growth and endocrine organ weights and histology. The following effects of salivariadenectomy are reported:

1. Upon food and water consumption and body growth.
2. Upon adrenal, uterine, and testicular weights and adrenal histology under both controlled and ad libitum feeding conditions in older rats.
3. Of both salivariadenectomy and a sham operation upon adrenal histology and cytochemistry in young rats. In addition, the effect of adrenocortical hormone upon salivary gland histology has been studied
4. Upon male and female reproductive organ weights 30 days after the operation.
5. Upon the histologic appearance of the ovary and uterus. These tissues were examined at varying time intervals after the operation.
6. Upon pituitary gonadotropin content as determined by pituitary assay in hypophysectomized rats.

The results indicate that salivariadenectomy impairs the animal's ability to gain weight at a normal rate. Controlled feeding experiments emphasize that food and water consumption are important factors in this effect. Similarly, observed weight changes in the uterus, testis, and adrenal glands seem to be dependent upon the altered nutritional status resulting from salivary gland removal.

Adrenocortical changes not directly attributable to nutritional alterations were observed. Alteration in the lipid and birefringent material in the adrenal cortex of salivariadenectomized rats suggested cortical hyperactivity. This condition persisted for approximately four days after the operation. Although no marked adrenocortical changes were observed in sham operated animals, this effect seems to be the result of surgical stress, a non-specific phenomenon.

The reproductive organs of salivariadenectomized rats are markedly retarded in development. Histologic study of the female organs revealed a reduced folliculogenesis

and interstitial luteinization in the ovary. Corpora lutea were reduced in number and atypical in appearance. The uteri of these same animals were small and undeveloped. Bioassay of the pituitary gonadotropins of 60-day old salivariadenectomized females revealed three times as much FSH present as in comparable control pituitaries. An increased amount of LH was also indicated in these animals.

The following general conclusions may be drawn from these results:

1. Salivariadenectomy alters the normal nutritional conditions of the experimental animal. This in turn may result in endocrine organ weight changes.
2. The observed adrenocortical hyperactivity is most likely the result of non-specific stress and does not indicate any salivary-adrenal gland relationship.
3. The failure of the reproductive organs to develop normally is due to an inhibition of the release of pituitary gonadotropins. This inhibition may be related to the adrenal hyperactivity. 76 pages. \$1.50. Mic 56-3570

#### A CYTOCHEMICAL AND ELECTRON MICROSCOPIC STUDY OF NUCLEOLI IN AMPHIBIAN OOCYTES

(Publication No. 19,072)

Charles Augustus Brown, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Hans Ris

Nucleoli in oocytes of the salamander *Triturus viridescens* have been investigated by means of cytochemical methods and with the electron microscope.

A series of four arbitrary stages in oocyte growth were formulated with particular reference to nucleolar behavior. In younger oocytes, the nucleoli are generally large and located at the periphery of the nucleus. Other smaller nucleoli are distributed throughout the nucleoplasm. With growth of the oocyte, the nucleoli migrate to the center of the nucleus where they aggregate around the chromosomes. In the latest stage of development, the nucleoli show signs of disintegration. They fragment, and vacuoles form.

Cytochemical staining methods indicated that oocyte nucleoli contain proteins and pentose nucleic acid. All cells contained one or two large nucleoli which did not stain with toluidine blue at pH 4.2, indicating that they do not contain PNA. Structurally, these nucleoli appear similar to other nucleoli. It is suggested that these nucleoli may correspond to nucleoli in somatic cells.

Other cytochemical tests showed that oocyte nucleoli do not contain DNA, lipids, phospholipids, alkaline or acid phosphatase, or polysaccharides.

Electron micrographs revealed that all oocyte nucleoli have a similar structure. They are composed of rods or fibers 100-150 Å in width, with an apparent central hole of about 35-40 Å diameter. The 100-150 Å structures may occur singly, in bundles, or in rows. Between them there is an amorphous material. The electron density of the nucleoli and compactness of component structural rods or fibers was variable. In some nucleoli, the structures appeared to be tightly packed, in others they had a loose arrangement. In the latter instance, the nucleoli showed

more amorphous material. In no case was a limiting membrane observed.

It is suggested that the tubular structures observed in oocyte nucleoli may be characteristic of certain nucleoproteins. This conclusion is based on the fact that other nucleoli, chromosomes, and tobacco mosaic virus have a similar fine structure.

Mass determinations were made with a Cooke Dyson interferometer microscope. It was observed that nucleoli with approximately the same area may show a variation in total dry mass. This observation was compared with results obtained by electron microscopy in which it was seen that nucleoli of approximately the same size could exhibit differences in electron density and compactness of structural units.

Estimations of pentose nucleic acid in oocyte nucleoli were also made. This was done by determining dry mass by microscopic interferometry before and after digestion with ribonuclease. The results indicated that the amount of PNA in oocyte nucleoli could differ widely in nucleoli of the same area and mass. In general, the amount was less than 15 per cent, however in some cases, the amount exceeded this percentage. There appeared to be no increase or decrease of PNA in nucleoli as the oocyte matured.

The two major chemical components of somatic cell nucleoli and amphibian oocyte nucleoli are proteins and nucleic acid, (except for the ones which do not contain PNA which were mentioned above). In addition, the fine structure of amphibian oocyte nucleoli is similar to that of nucleoli from a variety of other tissues. We conclude from this investigation the chemically and structurally, the many nucleolar-like bodies found in the nucleoplasm of developing *Triturus viridescens* oocytes are indeed similar if not identical to those in somatic cells.

150 pages. \$2.00. Mic 56-3571

#### SOME ASPECTS OF THE CHANGES IN THE ENZYME SYSTEM IN RAT LIVER WHICH INACTIVATES ESTRADIOL-17 $\beta$ DURING LATE FETAL AND EARLY INFANTILE DEVELOPMENT

(Publication No. 17,302)

Frieda Urey Brown, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Roland K. Meyer

The purpose of this investigation was to compare the livers from fetal, newborn, and day old rats with respect to their abilities to inactivate estradiol-17 $\beta$ .

The ability of rat liver to inactivate estradiol-17 $\beta$  was determined by measuring the amount of estrogen remaining after incubating liver homogenate with the estrogen in the presence of diphosphopyridine nucleotide and nicotinamide for two hours at 37-38° C. The residual estrogen was determined by the mouse uterine weight method. Differences in the abilities of the rat livers are expressed in terms of differences in the mean uterine weights of the assay mice injected with the residual estrogen.

The liver from day old and adult rats shows increased activity with respect to its ability to inactivate estradiol-17 $\beta$

over that of liver from fetal and newborn rats. This is interpreted to mean that rapid development of the enzyme system occurs during the first 24 hours after birth. It is suspected, but not proven, that milk plays a role in the development of the system because the activity is markedly increased in the suckling rat but not in 23 day fetal rats whose birth has been delayed nor in rats starved from birth for 24 hours.

*In vitro* studies failed to reveal a known coenzyme which will increase the activity of the liver from younger rats. The addition of boiled adult liver homogenate increases the activity markedly, indicating that the development includes an increase in the concentration of some cofactor. Milk obtained from the stomachs of day old rats contains a factor which increases the activity of liver from fetal and newborn rats. This factor seems to be associated with the milk fat. Milk also contains a factor which inhibits the activity of liver from day old or adult rats, but not of fetal rats.

The recovery of the activity of adult liver homogenate in the supernatant obtained by centrifuging the homogenate at 8,500 x g was almost 100%. Only about 60% of the activity in liver from one day old rats and none of that in liver from fetal rats was recovered in this fraction. Further fractionation of this supernatant into microsomes and supernatant at 18,000 x g and recombination of the fractions from livers of fetal and day old rats with those from adult liver revealed a marked difference in the activities of the microsomes. This is interpreted to mean that in addition to changes in the concentration of cofactors, one or more of the enzymes is increasing in the microsomes during this period of differentiation.

The livers from all age groups can inactivate estrone as well as estradiol-17 $\beta$ . As is the case with estradiol-17 $\beta$ , the adult liver is more active than the other three age groups, and the day old more active than the younger age groups. The data from studies using estriol and estradiol-17 $\alpha$  as substrates did not lend themselves to clear cut interpretation.

A brief study on the activity of guinea pig liver indicates that in this species the differentiation of the system for inactivating estrogens progresses gradually, with no marked increase in activity at birth.

110 pages. \$1.50. Mic 56-3572

#### OBSERVATIONS ON THE FLUCTUATIONS OF ACARINE POPULATIONS FROM NESTS OF *PEROMYSCUS LEUCOPUS*

(Publication No. 17,796)

Roger Otto Drummond, Ph.D.  
University of Maryland, 1956

Supervisor: Dr. George W. Wharton

Fluctuations in numbers and kinds of mites leaving nests of *Peromyscus leucopus noveboracensis*, the wood mouse, were investigated. In order to collect mites leaving nests without destroying the nests, a new procedure, the nest-funnel technique, was developed. Funnel were attached to bottoms of nest-boxes which were constructed with floors of hardware cloth so that mites could escape

from the nest-boxes into the funnels. Caps of 4-ounce bottles were soldered to the narrow ends of funnels. Liquid contained in bottles which were screwed onto the caps captured mites entering the bottles from the funnels. Bottles which were replaced each week were taken to the laboratory and mites collected in them were counted and identified. Numbers and kinds of mites from each nest-funnel were recorded weekly during a twenty-month period.

At the time the bottles were exchanged, nesting activity and the presence or absence of mice in the nest-funnels were noted; the air temperature of the study area at Patuxent Refuge, Bowie, Maryland, was recorded. Daily records of air temperature from Ft. Meade weather station were used to supplement weekly data recorded in the area under study. Effect of nesting activity of mice and climatic conditions upon the observed fluctuations in numbers and kinds of mites were considered.

There were 139 species of mites collected from the nest-funnels. Four species were collected from funnels which were protected from mice. Forty-one additional species were collected from nest-funnels after they had been visited by mice, 59 additional species were collected from nest-funnels after nesting material was carried in by mice, and 35 additional species were collected from abandoned nest-funnels. It was therefore concluded that 4 species were in the habitat before nesting activity of mice became a factor, 41 species entered the nest-funnels on mice, and 59 species entered on the nesting material carried in by mice. There were more species per collection from nest-funnels which were occupied or recently abandoned by mice than from nest-funnels which were never observed occupied by mice or had been abandoned for more than four weeks.

Species were grouped into three classes based on dietary habits: (1) parasitic, (2) predaceous, and (3) miscellaneous. Proportions of total number of species in the three groups were affected by neither activity of the mice nor climatic conditions.

A total of 17,201 mites was collected from nest-funnels; 29.0% were parasitic; 21.1% were predaceous; 35.9% were miscellaneous feeders; the feeding habits of 14.0% could not be determined. There were more mites per collection from nest-funnels which were occupied or recently abandoned than from nest-funnels which were never observed occupied or abandoned for more than four weeks.

Fluctuations in numbers of a parasitic mite, Haemolaelaps glasgowi, were also studied. Of the 1,748 H. glasgowi collected, more were collected per week from nest-funnels which were occupied or recently abandoned by mice than from nest-funnels which were never observed occupied or abandoned more than four weeks.

The fluctuations in numbers and kinds of mites could be also correlated with changes in climatic conditions. There were more species, total mites, and H. glasgowi per collection in early spring than in any other season; there were less species, total mites, and H. glasgowi per collection in summer than any other season. However, there was more nesting in spring and less nesting in summer than in any of the seasons so that differences in numbers and kinds of mites escaping during these seasons could be correlated with nesting activity as well as seasonal climatic conditions.

Nesting activity of the mice was the environmental factor which had the greatest effect on the fluctuations of acarine populations from nests. 126 pages. \$1.70. Mic 56-3573

## AGE, GROWTH AND REPRODUCTION OF THE MOUNTAIN WHITEFISH IN PHELPS LAKE, WYOMING

(Publication No. 18,498)

Harold Kolstoe Hagen, Ph.D.  
University of Washington, 1956

The Rocky Mountain whitefish, Prosopium williamsoni (Girard), is an abundant and increasingly important game fish in many northwestern regions of the United States and in parts of Canada. Little is known about its life history, especially in lakes.

It was found in Phelps Lake, Wyoming that the whitefish rarely occupied depths over sixty feet and usually ranged in depths between fifteen and sixty feet. The diet of the fish was almost exclusively zooplankton during the summer months. There is a definite congregation of adult whitefish in the twenty to forty-foot depth zone with the approach of the spawning season. Little variation was found between growth or length of the female and male whitefish. A slight variation in weights at similar lengths of the two sexes was found. The Phelps Lake whitefish are first fully scaled at forty millimeters fork length. The time of the new annulus formation was found to be either in late May or early June. The relationship of scale growth and body growth is not linear. The relationship of scale radius to any given length, however, is constant from year to year and between sexes. In Phelps Lake the whitefish rarely exceed nine years of age. The whitefish of Phelps Lake grow more slowly and remain smaller than whitefish in adjacent streams and in some adjacent areas. It is possible that an interchange of fish occurs between the lake and the Snake River but no evidence of this was found. The adult whitefish show practically no growth after the middle of October until late in June. The influence of temperature is reflected in the increase in growth but this is probably an indirect reflection of an increased food supply. The heaviest proportionate natural mortality was indicated from ages Seven through Nine. The age of maturity for most Phelps Lake whitefish is in their third year after the formation of the second annulus. Whitefish with four annuli were all found to be mature. The female whitefish mature later than the males. Two distinct rates of ova development were found. It was also found that both early and late maturing ova were spawned during the same season and not on alternate seasons. The late maturing ova were slightly smaller in diameter than the early maturing ova. Testes showed some evidence of variation in maturation. The number of eggs produced by the Phelps Lake whitefish average 7,757 per pound of fish and made up approximately nineteen per cent of the body weight just prior to spawning. The time of spawning in Phelps Lake is associated with temperature, but contrary to most reports the Phelps Lake whitefish started spawning on an increasing temperature. Spawning started in late September or early October and continued into November. Mountain whitefish spawn within the limits of Phelps Lake and do not attempt to enter the inlet or outlet although both are available to them. Young whitefish generally remain in the lake after hatching but were found to ascend the inlet stream a short distance. Whitefish spawned along many sections of the Phelps Lake shoreline. The erection of the pearl organs of the male seems to be directly associated with the spawning act and serves as an index to the time of actual spawning. 186 pages. \$2.45. Mic 56-3574

I. THE EFFECT OF THYROID INHIBITION ON THE GROWTH OF THE DRV TUMOR IN C3H MICE.  
 II. A COMPARATIVE MORPHOLOGICAL STUDY OF THE THYROIDS OF C3H AND C57 MICE.

(Publication No. 17959)

Barbara Beaman Jacobs, Ph.D.  
 Indiana University, 1956

Experiments dealing with the effects of thyroid activity on tumor growth in mice have yielded discrepant results and a review of the literature suggests that these discrepancies might be due to such factors as strain differences, age during treatment, and the method of thyroid manipulation which were employed. The first part of this study deals with the effects of two different methods of thyroid inhibition on the growth of the DRV transplantable tumor. It was found that propylthiouracil administration starting one month before or one month after tumor transplantation lowered the incidence of the tumors and inhibited their growth. When thiouracil administration was started at the same time that the tumor was transplanted, there was a higher percentage of tumors than was present in the controls but again the tumors were smaller than they were in the controls. The thiouracil-fed mice weighed considerably less than did the controls. Evidence of impaired ovarian function in the experimental animals was presented.

$I^{131}$  administration destroyed the thyroid glands but did not alter the body weight, tumor weight, or tumor incidence of the experimental animals. The impairment of gonadal function was present, but was manifest to a lesser degree than it was in the thiouracil-fed mice. The pituitaries of the  $I^{131}$ -treated mice weighed about twice as much as did those of the thiouracil-fed or control mice. Changes in pituitary morphology were present in both the thiouracil and the  $I^{131}$ -treated mice. The nature of these changes has not yet been investigated.

It was proposed that neither caloric restriction nor impaired thyroid function alone inhibited the growth of this tumor. The presence of both of these factors in the thiouracil mice might act synergistically to inhibit tumor growth. It is suggested that the tumor inhibition resulting from the combination of caloric restriction with hypothyroidism might inhibit the secretion of pituitary gonadotropins and thus impair gonadal function. The tumor inhibition might then be a result of decreased gonadal hormones.

Part II is a study of the thyroid morphology of C3H and C57 mice with references to age, sex and breeding activity. It was felt that such a study on normal mice might aid in the design and interpretation of experiments involving thyroid manipulation. Preliminary observations were also made on the thyroids of mice bearing spontaneous mammary tumor. The diameter of thyroid follicles and the height of the follicular epithelium were used as measures of thyroid activity. A high follicular epithelium and a small follicle diameter are indicative of an actively secreting thyroid gland. The observations of the thyroids of 863 mice ranging in age from one to eleven months, show that there are differences in thyroid activity that are dependent on age, strain, and breeding activity. The follicle diameters of the C3H strain were larger than those of the C57 strain but there were no consistent differences in the epithelial height measurements. Both follicle diameter and epithelial height measurements indicate that in

both strains thyroid activity decreases with increasing age and that breeding females have a lower thyroid activity than do males or virgins. It was also noted that the presence of spontaneous mammary tumors in C3H mice is associated with lowered thyroid activity as compared to non-tumor bearing mice of corresponding age. The importance of taking the variables of age, strain, sex, and breeding activity into account when designing and interpreting thyroid experiments is emphasized.

98 pages. \$1.50. Mic 56-3575

NATALITY FACTORS OF SELECTED SPECIES OF PHYLOPODS

(Publication No. 18,584)

Robert Withers Kelly, Ph.D.  
 University of Missouri, 1956

Supervisor: Peter W. Frank

The influence of several factors: drying, freezing, pH, oxygen tension, salt concentration and various combinations of these on natality of phyllopod eggs was determined. The selection of experimental factors was made with reference to ecological conditions found in nature. The reaction obtained as a result of the varied treatments are interpreted as adaptations to a specialized environment.

The species studied most intensively were Caenestheriella gynecia, Streptocephalus sealii and Thamnocephalus platyurus, with less detailed investigations of Caenestheriella setosa, Eulimnadia texana, Eubranchipus serratus, Streptocephalus texanus and Apus longicaudatus. All of the species listed, except C. gynecia, are native to Missouri.

Most adult phyllopods were brought from natural pools into the laboratory where the eggs were collected after having been shed. Laboratory cultures of C. gynecia were maintained.

In hatching experiments the eggs were counted and placed in containers with a tap or synthetic pond water medium. A control was used with each set of experiments and the experiments were suitably replicated. Observations were made of the time required for hatching to commence, duration and the number which hatched each day.

One of the most striking results was the heterogeneity both within and between species as regards hatching. There are apparently two types of eggs formed by T. platyurus and S. sealii; one of which will hatch immediately and the other only after specific treatment. The effective inducers differed in the two species, drying for eggs of S. sealii and freezing or low oxygen tension for those of T. platyurus. The eggs of C. gynecia were not appreciably affected by either drying or freezing, but low oxygen tension increased the percentage hatch.

It was found that a more alkaline medium and a medium with a greater salt concentration increased the percentage hatch of C. gynecia ova. Neither of these factors greatly affected the natality of S. sealii nor T. platyurus.

The time required for the nauplii to emerge from the eggs had been primarily attributed to the incubation temperature. It has been shown that temperature is important in this respect, but quick hatching is evidently a

consequence of previously inhibited development, correlated with temperature, salt concentration or drying at critical periods.

In general, some species appear to have eggs of only one type. These eggs are resistant to both freezing and drying, but neither is essential. There are other species which have more than one type; eggs which will hatch without being dried or frozen, and others which appear to benefit, or perhaps require, one or the other. The inherent heterogeneity, a short life cycle and resistant eggs all promote the survival of the species.

218 pages. \$2.85. Mic 56-3576

**THE STRUCTURE OF THE SPERMATOZOOON OF THE SILVER SALMON, ONCORHYNCHUS KISUTCH (WALBAUM)**

(Publication No. 18,503)

Frank George Lowman, Ph.D.  
University of Washington, 1956

Sections and whole mounts of spermatozoa of silver salmon were investigated with the electron microscope. Standard techniques were used which are described in detail.

A historical review is given and the present observations are compared with those of other investigators.

The salmon spermatozoon is entirely covered by a membrane 80A in thickness and, in addition, is composed of (1) the head, containing the nucleus, nuclear membrane, mitochondrial granules, and a matrix; (2) the middle piece, composed of centrioles, mitochondrial granules, a tentatively identified Golgi remnant, and a matrix; and (3) the tail, consisting of the axial filament, mitochondrial granules, and a matrix.

In the tail the cell membrane is formed into two oppositely placed longitudinal folds, spirally wound five to seven times around the axial filament throughout its length of 28 to 35 microns.

The head is ovoidal with dimensions of about one and one-half by two microns. It is composed almost entirely of the nucleus covered by a 100A-thick nuclear membrane. In sections the nucleus is without visible internal structure and is of high density.

The mitochondrial granules, 300A to 2000A in diameter, surround the nucleus, are concentrated in the middle piece near the origin of the axial filament, and are distributed throughout the length of the tail in the lateral folds of the cell membrane.

The so-called Golgi remnant is comprised of osmophilic material surrounded by a 100A-thick membrane. The membrane exhibits invaginations into the central material. Sections of the invaginations appear as irregular vesicles inside the Golgi remnant.

The centrioles are found in a deep depression of the nucleus on its posterior side. The proximal centriole is of two parts: an anterior hemisphere, 2700A in diameter and 300A thick, in contact with the bottom of the nuclear depression; and the posterior portion, which is cylindrical, 1800A in diameter, 700A long, lying inside and against the bottom of the hemispherical anterior portion. The distal centriole is cylindrical, 1500A in diameter, 1700A long,

and abuts against the posterior proximal centriole. The peripheral fibrils of the axial filament originate at the anterior surface of the distal centriole and are embedded in its wall.

The axial filament extends the length of the tail and is comprised of eleven fibrils. Nine fibrils are 320A to 400A in diameter and form a tubiform structure about 1800A in diameter, in the center of which lie two smaller fibrils 220A to 300A in diameter. The configuration of nine peripheral and two central filibrils is found in the cilia and flagella of fifty-one genera, representing eight phyla of plants and animals.

The nine peripheral fibrils of the salmon spermatozoon each contain five protofibrils of about 60A diameter. The two central fibrils each contain four protofibrils.

Salmon spermatozoa, when placed in hypotonic media, develop marked areas of swelling along the tail concurrently with cessation of motility, indicating the inability of the cell membrane to exclude water from the cell.

Although the tail increases in volume as much as forty-five times in the areas of swelling, the axial filament retains its normal cross-sectional configuration. The stability of the axial filament, its fibrillar structure, the fact that it has the same cross-sectional pattern wherever found, and the observation in several species that the two central fibrils always lie on a line normal to the plane of motion, suggest that the axial filament is the contractile organ for motility. 128 pages. \$1.70. Mic 56-3577

**A REGIONAL COMPARISON OF COTTONTAIL RABBIT REPRODUCTION IN OHIO**

(Publication No. 18,815)

Norman Curtiss Negus, Ph.D.  
The Ohio State University, 1956

The factors responsible for high and low population densities of cottontail rabbits (*Sylvilagus floridanus mearnsi*) in different regions of Ohio have not been clearly defined. In the investigation, an approach to the problem was made through an intensive study of reproductive phenomena in cottontail rabbit populations. A method was devised for aging rabbits in the field by pelage characteristics which enabled subadults to be differentiated from adult rabbits. Reproductive activity of young females was determined by examination of the uteri and microscopic examination of the ovaries. A double staining technique was used with Delafield's hematoxylin and eosin red stains on ovaries sectioned at 45-50 microns thickness to aid in differentiating corpora lutea from corpora albicantia. Use of this method made it possible to determine the size of as many as four successive litters produced by a single breeding female. Comparisons were made of litter sizes, weights, and humeri lengths and weights from samples of rabbits taken from good and poor soil types in Ohio. Bluegrass (*Poa pratensis*) samples from the same areas were collected and analyzed for calcium and phosphorus content. New Zealand White rabbits were used in a controlled breeding experiment to determine the persistence and reliability of placental scars and corpora lutea and albicanitia as indicators of litter size and number of litters produced. A series of embryos of known age was obtained

from New Zealand White rabbits which provided criteria for aging cottontail rabbit embryos. Data were also collected regarding the length of the breeding season and the relationship of reproductive activity to molting in adult animals.

158 pages. \$2.10. Mic 56-3578

#### **EXPERIMENTS FOR THE MODIFICATION OF X-RAY MUTAGENESIS IN *DROSOPHILA MELANOGASTER***

(Publication No. 17,974)

Irwin Isaac Oster, Ph.D.  
Indiana University, 1956

In order to obtain further information about the conditions affecting the sensitivity of germ cells to the induction of mutations by ionizing radiation, a series of experiments was undertaken which involved studying the effects of varying different cytophysiological factors or adding supplementary chemical treatments on the radiosensitivity of *Drosophila melanogaster*. For this work a number of specially constructed stocks which allowed for the detection of the frequencies of induced chromosome loss, lethal mutations, and translocations were used. Modified mating procedures insured that the germ cells which were treated and tested were relatively homogeneous as regards their stage of development.

An analysis of the results obtained from fractionating the dose delivered to spermatozoa and spermatids confirmed the fact that chromosome breaks produced by X-rays in mature spermatozoa do not undergo restitution or reunion until fertilization whereas breaks induced during the spermatid stage were found to undergo joining during spermiogenesis. Spermatids were shown to represent the most radiosensitive stage of germ cell development, yielding induced lethal mutation and translocation rates of 14.2% (98/698) and 32.2% (135/419), respectively, as compared to 5.9% (68/1178) and 10.5% (139/1322), respectively, obtained by irradiating spermatozoa in the inseminated female. That the high frequency in spermatids did not involve a hindrance to restitution caused by separation of broken chromosomes during the elongation of the spermatids to form the spermatozoa was indicated by finding that equivalent lethal mutation rates were induced in rod and ring X chromosomes in spermatids. For if the heightened sensitivity of the spermatids was due to a "shuffling" of broken chromosome parts, a portion of those lethals associated with structural changes of the ring chromosome would be lost via twisted restitutions, thereby reducing the frequency of lethals obtained from a ring as compared with a rod chromosome. Irradiation (600r) of spermatids containing either a rod, ring, or Y-chromosome-bearing X (Novitski's) yielded the following rates of lethals: 5.4% (65/1208), 6.2% (31/504), 6.9% (72/1050), respectively. The corresponding results for spermatozoa (2000r) were: 5.9% (153/2581), 5.8% (60/1041), 7.5% (26/349), and for spermatogonia (2000r) 0.8% (41/4867), 0.1% (5/2475), and 0.2% (9/2146). In computing these frequencies the control frequencies (0/893, 1/705, 3/1531) have been subtracted. The possible cause(s) for the similar rates obtained after irradiating spermatids and spermatozoa bearing either a rod, a ring, or Novitski's X and the dissimilar ones

obtained after treating the same chromosome types during the spermatogonial stage are discussed.

Combination treatments of mature spermatozoa with mustard gas ( $\beta\beta'$ -dichlorodiethyl sulfide) and X-rays and with urethane (ethyl carbamate) and X rays gave purely additive effects and showed that the breaks produced by X rays were able to recombine freely with those induced by mustard gas or those formed by urethane. Although this does not necessarily mean that these three mutagens act via identical pathways, it does indicate that the final products (i.e., the open breaks) are equivalent. Oral administration of nearly toxic doses of colchicine, acenaphthene, and cobalt chloride to females and subsequent irradiation resulted in the following frequencies of lethal mutations when the cells which were oogonia at the time of irradiation were tested genetically: 5.5% (71/1301), 7.6% (17/225), and 4.7% (10/219), respectively, while non-prefed irradiated females (controls) gave 2.6% (70/2739). The positive effect of colchicine and acenaphthene on X ray mutagenesis is probably caused by an accumulation of cells having condensed chromosomes which are very susceptible to the action of X rays. The metal salt presumably acts by accumulating and reacting with the active radicals produced by the radiation.

On the other hand our comparison of the frequencies of lethal mutations induced in spermatids and spermatozoa, both of which have condensed chromosomes also, has suggested that some other factor(s) is responsible for the greater sensitivity of the former cells.

60 pages. \$1.50. Mic 56-3579

#### **A CONTRIBUTION TO THE POPULATION DYNAMICS AND HOMING BEHAVIOR OF NORTHERN WISCONSIN LAKE FISHES**

(Publication No. 19,125)

Richard Alan Parker, Ph.D.  
The University of Wisconsin, 1956

Supervisor: Professor Arthur D. Hasler

Flora Lake, a 102-acre body of water in Vilas County, Wisconsin, was the site of a five-year program in which the density of fishes was reduced primarily with fyke nets in an attempt to increase the growth rates of important fish species. Annual quantities removed ranged up to 2481 pounds (887 kg.), or 52.6 percent of the catchable standing crop at the time of the estimation of the population in early summer.

A second-degree polynomial was fitted to the data on calculated, total length at each year of life before 1952 as based upon scale-analyses. Moreover, appropriate confidence intervals about this pre-treatment growth curve were used to distinguish significant changes in the rate of growth from "normal" fluctuations. The covariance technique was employed to test for a difference between adjusted, mean, logarithmic weights of specimens collected in 1952 and in 1956.

No important changes occurred in the linear growth rate of largemouth bass *Micropterus salmoides*; however, individuals were heavier, at a given length, in 1956 than

in 1952. In addition, the total weight of bass over 5.1 inches (130 mm.) in length rose from 3.8 to 6.1 pounds per acre (4.3 to 6.8 kg./ha.), and the angling-yield increased from 34 pounds (15.4 kg.) in 1952 to 145 pounds (65.8 kg.) in 1955, although the effort remained nearly constant.

The 1953 and 1954 year classes of bluegills (Lepomis macrochirus), pumpkinseeds (Lepomis gibbosus), and hybrids of these two species responded favorably in linear growth rate, as did some year classes of rock bass (Ambloplites rupestris) and common white suckers (Catostomus commersonii). No change of this nature could be detected in the growth of golden shiners (Notemigonus crysoleucas); however, yellow perch (Perca flavescens) showed a marked decrease. Besides the largemouth bass, bluegills, pumpkinseeds, and suckers were "fatter" in 1956 than in 1952. No difference could be demonstrated for rock bass and hybrids, while perch and golden shiners were considerably "thinner".

Genetic background, differential rates of reduction during the experiment, and competition are discussed as possible reasons for the inconsistent effect on growth following a reduction in density of the population.

During the summer of 1955, largemouth bass from Flora Lake and Dadek Lake, and bluegills, pumpkinseeds, and bluegill x pumpkinseed hybrids from Flora Lake, were caught in fyke nets, marked as to area of initial capture, and displaced to a central point in order to investigate further the homing behavior of these centrarchids. Data on the numbers of fish marked at one station which were recaptured at any other station, and the shortest distance via water between stations as measured in 10-foot units, were utilized in a regression analysis which yielded a theoretical curve of the relative distribution of marked individuals with respect to their "home" territory. Further analyses confirmed the possible existence of two groups in the population, one that "homes" and one that moves about at random. The segment of recaptured individuals which "homed" was estimated to be approximately 31 percent of the bluegills, pumpkinseeds, and hybrids in Flora Lake, 18 percent of the bass in Flora Lake, and 25 percent of the bass in Dadek Lake; by chance alone, 8.6 percent, 10.2 percent, and 9.4 percent, respectively. Some aspects of the mechanisms which displaced fish may employ in returning to a preferred area are discussed.

96 pages. \$1.50. Mic 56-3580

#### EFFECTS OF TEMPERATURE UPON YOUNG CHINOOK SALMON

(Publication No. 18,514)

Allyn Henry Seymour, Ph.D.  
University of Washington, 1956

During three experiments in successive years, temperature effects upon the chinook salmon, Oncorhynchus tshawytscha (Walbaum), from the egg to the fingerling stage have been observed. Observations included the effect of temperature upon the rate of embryological development, mortality, the occurrence of morphological abnormalities, growth rate, and the determination of the number of vertebrae, dorsal fin rays and anal fin rays.

For Experiment I eggs were obtained from one pair of

Green River salmon and reared for 46 weeks in city water maintained at constant temperatures ranging from 34° to 65°F. Experiment II duplicated I except that the temperature range was 45° to 67 1/2°F and the experiment was terminated during the tenth week. For Experiment III, chinook salmon eggs from the Green, Skagit, Entiat and Sacramento Rivers were used, the temperatures were altered throughout the experiment in a manner similar to that which occurs under natural conditions, well water replaced city water, and from one to four spawning pairs for each race were used. In all three experiments lots reared in the tap water as it was received at the hatchery were considered to be the controls.

The rate of development during incubation, at temperatures maintained at a constant level in the range from 40° to 58°F, was expressed adequately by either the temperature summation rule, the Belehradek equation, or an equation of the logistic curve. For all lots, regardless of temperature, mortality rate, race, or year the logistic curve was the best fit to the data. The temperature coefficients  $u$ ,  $Q_{10}$  and  $x$  were not constant.

New estimates of the threshold temperature and its confidence interval, as well as an estimate of the temperature summation constant, are given. Threshold temperatures for the egg lots from the Sacramento River Salmon were highest, for the Entiat River, lowest, and for the Green and Skagit Rivers, intermediate. The same order prevailed for the rate of development.

A common pattern was observed for the relationship of temperature to the number of vertebrae, egg mortality, the number of abnormal fry and the duration of the hatching period. For lots reared at temperatures in the range from 40° to 58° the values were low but increased at both higher and lower temperatures.

The temperature at which the optimum growth rate occurred for fingerlings reared at constant temperatures was approximately 55°F and for lots at city water temperatures, near 60°F. Taking into consideration both mortality and growth rate, the optimum temperature was about 52°F for eggs and fry and 58°F for fingerlings.

The minimum number of vertebrae and the maximum number of dorsal and anal rays were found to occur in the lots reared in the temperature range from 40° to 58°F. The range in number of vertebrae for the four races was 63 to 78, with practically no overlap in the number of vertebrae for chinook salmon of the Entiat and Sacramento races. Genotypical variation appeared to be greater than phenotypical.

Water of low oxygen during incubation increased the number of vertebrae and the incubation period.

137 pages. \$1.85. Mic 56-3581

#### THE SNOUT BEETLES OF OHIO (COLEOPTERA, CURCULIONOIDEA) (VOLUMES I AND II)

(Publication No. 18,821)

Elbert Launee Sleeper, Ph.D.  
The Ohio State University, 1956

The dissertation is a review of the families, subfamilies, tribes, genera, species, and subspecies of the snout

beetles which should occur in Ohio, with the exception of the old family Scolytidae. All available information pertaining to the biology and distribution of the species has been included.

One-hundred eighty-nine genera, 666 species, and 7 subspecies are included in the work. Three genera, Paraneomastix, Blatchlevanus, and Paranicentrus, and five species, are described as new. The latter are Ormiscus ohioensis, O. duryi, O. olentangyi, Pseudacamptus inconstans, and Microhyus elongatus.

The taxonomic arrangement proposed is quite different from that of most North American specialists, being closer to that used by the European specialists, and would seem to present a more satisfactory phylogenetic arrangement.

All of the large Ohio collections and most of the smaller collections were examined, as were the following, which are outside Ohio: National Museum, Purdue University, Illinois State Natural History Survey, and the Philadelphia Academy of Sciences.

Illustrations and keys are included to assist in the determination of the genera and species.

545 pages. \$6.95. Mic 56-3582

#### MICROPHONIC ACTIVITY IN THE SACCULE OF XENOPUS

(Publication No. 17,494)

Willem André Maria van Bergeijk, Ph.D.  
State University of Iowa, 1956

Chairman: Professor Emil Witschi

The microphonic potentials in the saccule of *Xenopus* larvae are used to indicate the activity of the otolith apparatus. They are picked up by small steel electrodes and displayed on a cathode ray oscilloscope. Data are read directly on the C R O screen or stored on tape and photographed later. Sounds from a loud-speaker and from tuning forks are used as stimuli.

Stimulus-response curves are obtained which show a lower limit of response at 20 c.p.s., and a higher limit of 150 to 300 c.p.s., depending on the animal. Just before the higher limit a two- to threefold increase of microphonic output is observed; the frequency at which this occurs is the same as the frequency of the spontaneous activity which can be observed in most animals.

Frequency doubling of the microphonic output appears to be caused by limitation of the movement of the otolith mass.

The mass of the otolith is estimated to be  $8 \mu\text{g}$ ; the compliance of the system is calculated to have a range of 0.05-0.26 cm/dyne. The friction of the system is calculated to be 0.83 mechanical milliohms.

A simple electrical analog circuit is constructed in which the stimulus-response curves and the frequency doubling can be duplicated.

The possible auditory functions of the saccular apparatus are discussed; since it is shown that the results should be interpreted as data on the performance of a mechanical vibrating system, the conclusion is drawn that the saccular apparatus may be of questionable value for sound perception.

46 pages. \$1.50. Mic 56-3583

#### PARASITIC EGG LAYING IN THE REDHEAD (AYTHYA AMERICANA) AND OTHER NORTH AMERICAN ANATIDAE

(Publication No. 18,597)

Milton Webster Weller, Ph.D.  
University of Missouri, 1956

Supervisor: William H. Elder

It is well known that the redhead duck lays eggs in the nests of other birds as does the European cuckoo. The purpose of this study was to determine the origin and degree of development of this behavior in the redhead, appraise the effect of this parasitism on the productivity of the host and parasite, and evaluate management procedures designed to reduce the degree of parasitism.

The study was conducted in the Delta Marsh in Southern Manitoba and the Knudson Marsh in Utah. Nests were visited weekly and each egg was examined with a field candler to determine when each was laid; thus the relation of parasitic laying to normal nesting was established. Parasitizing and incubating hens were studied by watching from blinds placed at nests and by trapping females and marking them with plastic head tags.

Parasitic females searched marsh vegetation for nests in which to lay. Usually four minutes were required for the hen to lay. The male waited nearby. Laying occurred at all hours of the day but was most frequent in the morning. Both yearling and adult females laid parasitically. The average number of parasitic eggs laid by each female was eleven. As many as thirteen females were trapped on one nest. More than one half of the parasitic eggs were deposited after the host started incubation and thus were destined not to hatch.

If the host was on the nest, she threatened and pecked the intruding parasitic hen but could not always deter her. Occasionally the host ejected or buried the parasitic egg but usually accepted it. Continued parasitic intrusion seldom caused nest desertion in canvasbacks or mallards but redhead females commonly abandoned their nests because they were much less broody.

Parasitism reduced clutch size of the host by twenty percent and reduced both egg and nest success when it was severe. Of all hosts, the canvasback suffers most severely from redhead parasitism because the breeding range and nesting habitat of the two species are identical.

No relationship was found between degree of parasitism and cover quality, water fluctuations, or disturbance by the investigator; but it was influenced by nesting chronology of the host, location of the host's nest, and the abundance of hosts and parasites.

Approximately ten percent of redhead females nested normally and did not lay parasitically, fifty to sixty percent laid parasitically and later constructed nests of their own, while the remaining one third were completely parasitic.

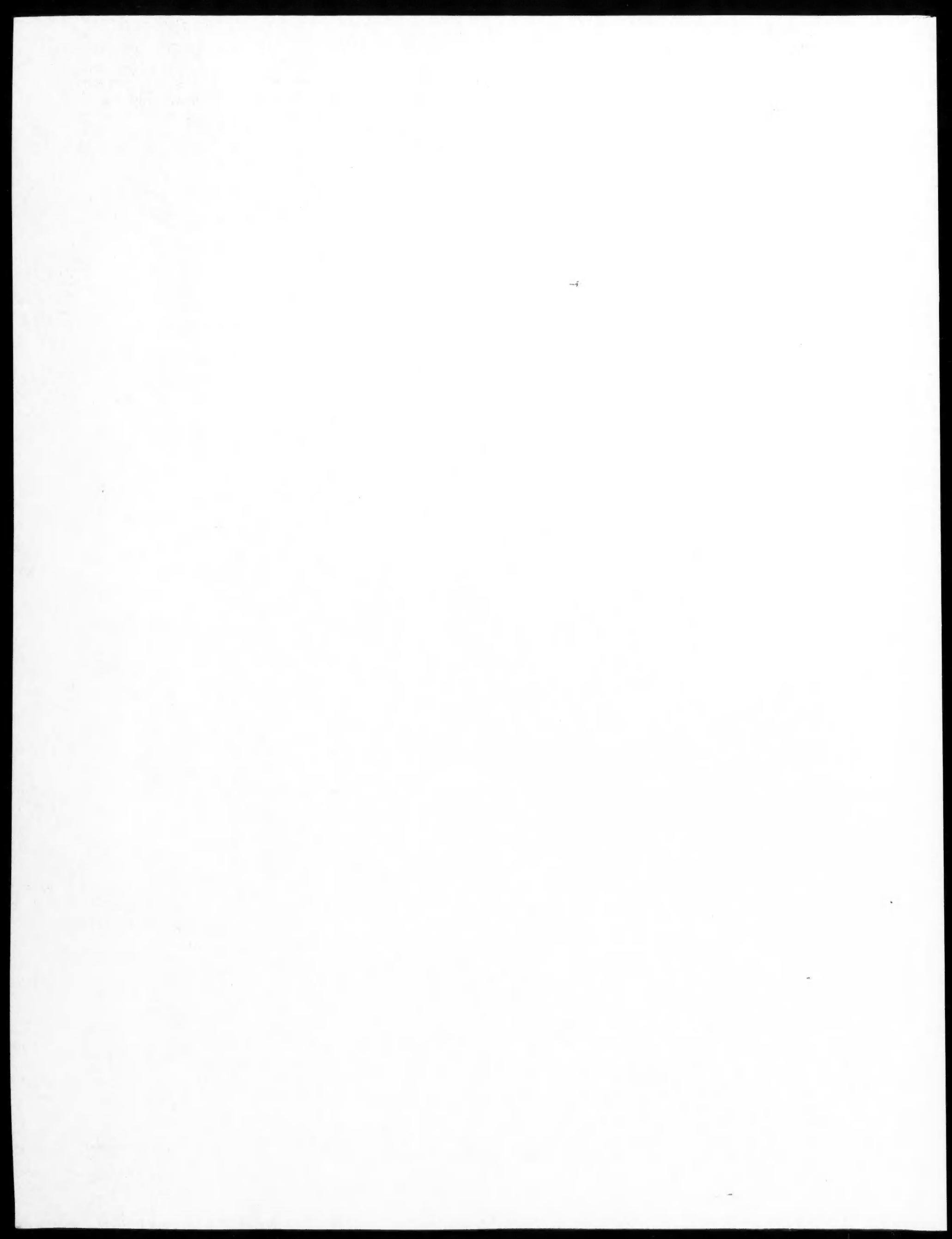
Parasitic laying in the redhead is in the developmental stage and is occurring as a natural consequence of the deterioration of normal maternal instinct. The cause of this may never be known but probably resulted from variation in the synchronization of nest building and laying and the normal broodiness that follows. Three stages follow this: laying in other birds' nests and later constructing a nest, laying in other birds' nests followed by the use of

an old nest for laying and incubating, and finally parasitic laying alone with no attempt at nesting.

As a result of the redhead's parasitic habits and weakened maternal instincts, the balance between natality and

mortality are so close that the size of the redhead population must be closely watched. Where possible, its nesting habitat should be managed to prevent nest losses from flooding.

173 pages. \$2.30. Mic 56-3584



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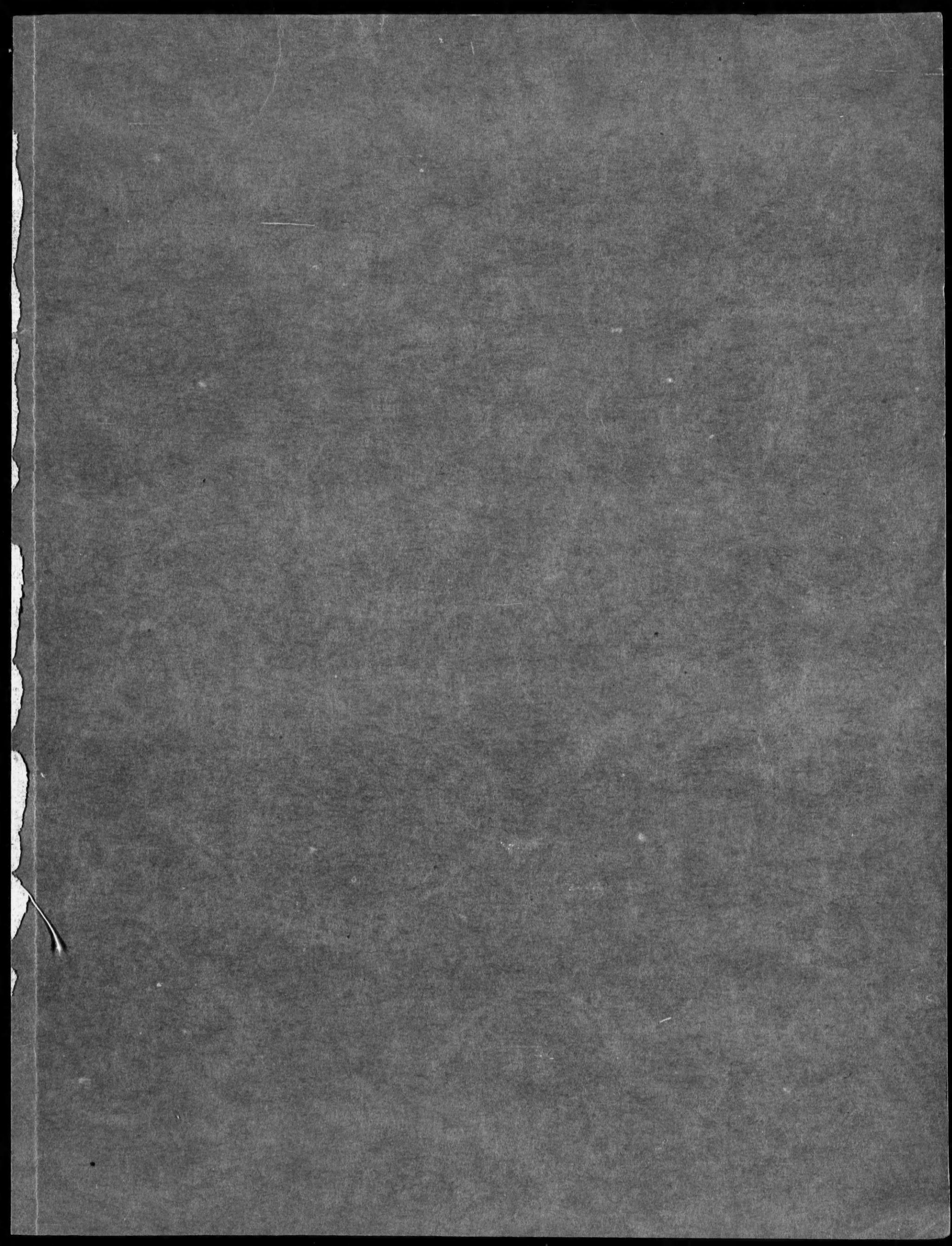
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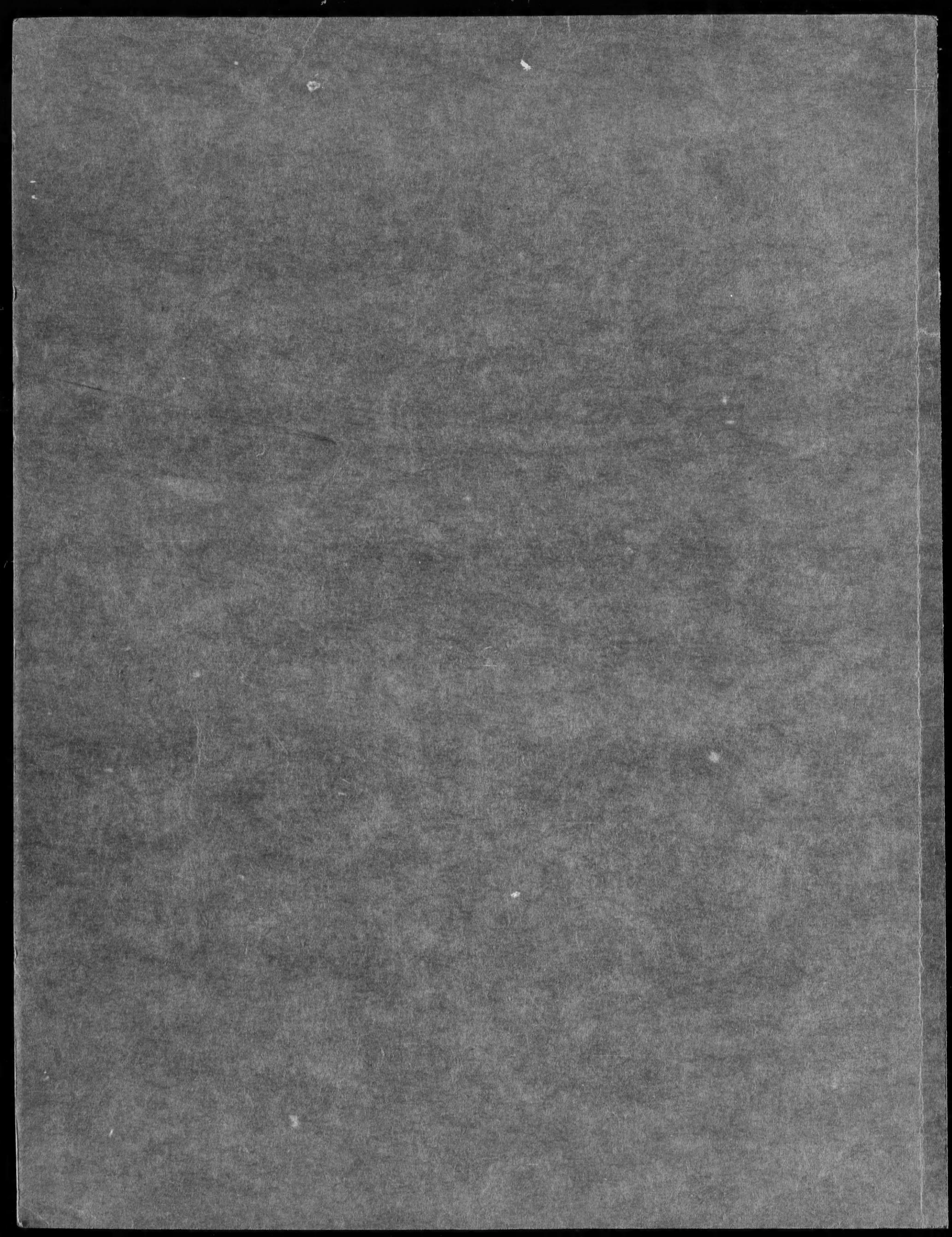
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